

AT THE BEGINNING OF the twentieth century,

physicists who aspired to understand the machinery of the cosmos ended up creating devices for burning civilizations. And now the Faustian bargain has appeared again, at the end of the century and millennium, promising the grail of knowledge to a new kind of scientist — the computational biologist. “Applied evolution” is what Kevin Kelly calls this whole new way of applying nature’s magic tricks to human needs. The time has come for people outside the artificial-life labs in New Mexico, Michigan, and Massachusetts to understand the coming biological revolution.

Computational biology is related to — but goes beyond — conventional bio-engineering, because it aims to discover the processes by which the evolutionary drive works its magic, then to apply those powers in an amplified, accelerated, focused manner.

Life is a certain kind of pattern, a pattern-reading and pattern-making pattern; whether that pattern is incarnated in DNA or instantiated in computer algorithms, the principles that cause complex forms to evolve from simpler ones seem to apply to silicon as well as carbon. The scientists who crack evolution’s code will have opened the portals to powers far greater than the energies at the heart of the atom.

It looks as if something even more powerful than thermonuclear weaponry is emanating from that same, strangely fated corner of New Mexico where nuclear physicists first knew sin. Those who follow the progress of artificial-life research know that the effects of messing with the engines of evolution might lead to forces even more regrettable than the demons unleashed at Alamogordo. At least nuclear weaponry and biocidal technologies only threaten life on Earth, and don’t threaten to contaminate the rest of the universe.

That’s the larger ethical problem of a-life. The technology of self-replicating machines that could

emerge in future decades from today’s a-life research might escape from human or even terrestrial control, infest the solar system, and, given time, break out into the galaxy. If there are other intelligent species out there, they might not react benevolently to evidence that humans have dispersed interstellar strip-mining robots that breed, multiply, and evolve. If there are no other intelligent species in existence, maybe we will end up creating God, or the Devil, depending on how our minds’ children evolve a billion years from now. The entire story of life on earth thus far might be just the wetware prologue to a longer, larger, drier tale, etched in silicon rather than carbon, and blasted to the stars — purposive spores programmed to seek, grow, evolve, expand. That’s what a few people think they are on the verge of inventing.

Scenarios like that make the potential for global thermonuclear war or destruction of the biosphere look like a relatively local problem. Biocide of a few hundred thousand species (including ourselves) is one kind of ethical problem; turning something like the Alien loose on the cosmos is a whole new level of ethical lapse.

The human species has precious little time to gain the wisdom necessary to handle the knowledge scientists have discovered. Artificial life is too important to remain

ARTIFICIAL LIFE, or a-life, is the study and creation of human-made systems that behave like living systems. The artificial organisms midwived by a-life researchers can exist in pots of chemicals or within the silicon maelstrom of a computer or robot. Like real organisms, they display independent behavior, often as a result of evolution, which can be produced by a digital version of natural selection. There are two points to doing artificial life. First, we will gain a better understanding of nature, of life itself. Second, we can create a powerful new technology based on nature’s most ingenious product — living organisms. The eventual benefits of artificial life are limited only by imagination: self-reproducing factories, microscopic disease-killing machines, a menagerie of lifeforms performing useful functions. —p. 34

an esoteric specialty. The time to think about what it might mean is now, while we still have a choice. Military applications of autonomous, self-reproducing robots might lead to worse fates than mere annihilation. There’s some question about whether it is ever possible to put knowledge back in the bottle, but there is no question

NATURAL SELECTION is a very grim natural reaper. Darwin made the bold claim that, at the very heart of evolution, many small deletions in bulk — many small wanton deaths — feeding on the throwaway optimism of minor variation, could, in a counterintuitive way, add up to something truly new and meaningful. In the drama of traditional selection theory, death plays the star role. It works singlemindedly by attrition. It is an editor that knows only one word: No. Variation counterbalances the one-note song of death by giving birth to the new in cheap abundance. It too knows only one word: Maybe. Variation cranks out disposable maybes in bulk, which are immediately mowed down by death. Bulk mediocrity is dismissed by wanton death. Occasionally, the theory goes, this duet produces a Yes!— a starfish, kidney cells, or Mozart. On the face of it, evolution by natural selection is still a startling hypothesis.

Death gives room for the new, it eliminates the ineffective. But to say that death causes wings to be formed, or eyeballs to work, is essentially wrong. Natural selection merely selects away the deformed wing, the unseeing eye. "Natural selection is the editor, not the author," says Lynn Margulis. What, then, authors innovation in flight and sight? —p. 4

RAY WOULD CHEERFULLY

admit the limitations of his system — he noted that several magnitudes of increased computer power would be required to support a system to evolve more complex creatures, one that could support life forms with the equivalents of both DNA and RNA, for instance, or multicellular organisms. But in a sense Tierra had already accomplished one of Ray's prime goals — the beginnings of a shift in perception caused by a successful implementation of open-ended artificial evolution. An indication of this came in the August 27, 1991, edition of the *New York Times*, declaring that, on the heels of Tierran evolution, "A new round of debate has developed among scientists as to where the dividing line between life and non-life may lie." A debate long anticipated by the proponents of artificial life.

Tom Ray had an additional viewpoint on the ability of Tierra to evolve the workings of biology from a digital soup: "The conclusion I draw from it," he says, "is that virtual life is out there, waiting for us to create environments for it to evolve into." —p. 22

Co-evolution might turn out to be as important as Stewart Brand suspected when he started this magazine. One thing that the a-lifers and the post-Darwinian theoretical biologists have agreed upon is the importance of the role of cooperation. Competition for resources, reproductive competition,

biological weaponry and defenses, are the most important active elements of traditional Darwinian evolution theory. The new picture emerging from biology has demoted competition and promoted cooperation. It turns out that symbiosis and other cooperative arrangements have far greater evolutionary leverage than old-fashioned "survival of the fittest." Do we need to rethink the way the world of political power is being transformed, now that we have alternate evolutionary models? Is cooperation a possible new paradigm for those who would retool the American defense and intelligence establishments? Revamping the military-intelligence community is another theme of this issue. Can our largest and most deadly collective institutions co-evolve along with our new understandings?

The future of artificial life on earth and beyond is a very big, very theoretical topic. The future of the military and intelligence apparatus is closer to home, but it is still on a larger-than-human scale. The matter of why and how to help other suffering beings brings the whole story right down to the place where you and I live our daily lives. Ram Dass, Mirabai Bush, Wavy Gravy, and others show us how they do it, and give us solid pointers about how we can go about putting compassion into action in our own lives.

Artificial Life to Army Green to Compassionate Action. That's this issue's trajectory. The poet-songwriter Robert Hunter puts it this way:

*Small wheel turn by the
fire and rod.*

*Big wheel turn by the
grace of God.*

*Every time the wheel turn
'round*

*Bound to cover just a little
more ground.*

—Howard Rheingold

that we still have time to make sure that the self-reproducing, increasingly intelligent, interstellar lifeforms that we are about to create are more closely modeled on E.T. than on the Alien.



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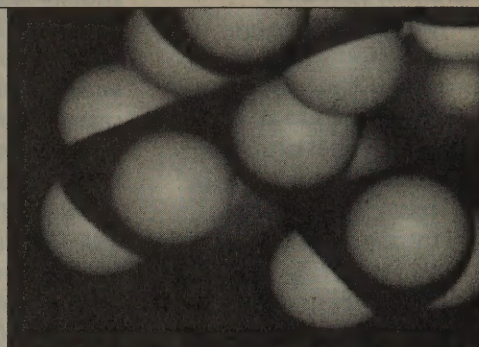
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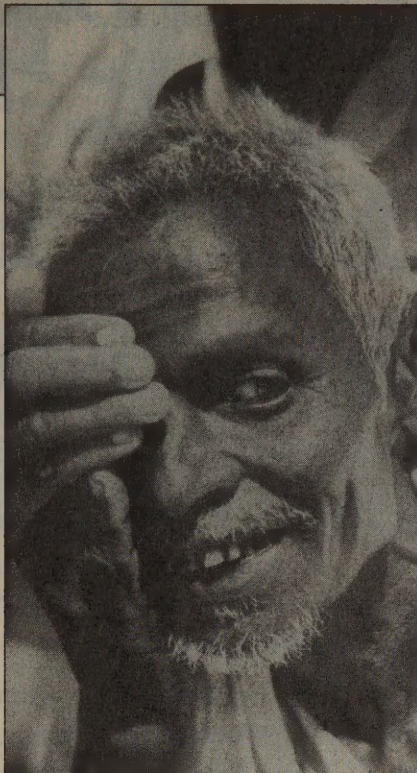
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DEEP DEEP EVOLUTION

The Emergence of Postdarwinism

BY KEVIN KELLY

“IT IS TOTALLY WRONG. It’s wrong like infectious medicine was wrong before Pasteur. It’s wrong like phrenology is wrong. Every major tenet of it is *wrong*,” says the outspoken biologist Lynn Margulis about her latest target: the dogma of darwinian evolution.

Margulis has been right about what is wrong before. She shook up the world of microbiology in 1965 with her outrageous thesis of the symbiotic origin of nucleated cells. To the disbelief of the traditionalists, she claimed that free-roaming bacteria cooperated to form cells. Then in 1974, Margulis again rattled the cage of biology by suggesting that atmospheric, geological and biological processes on Earth are so interconnected that they act as a single living, self-regulating organism — Gaia. Now Margulis is denouncing the modern framework of the century-old theory of darwinism, which holds that new species build up from an unbroken line of gradual, independent random variations.

The stigma of disagreeing with Darwin is so indelible that every scientist I’ve met who had anything remotely contrary to say against darwinism began with this short pledge of allegiance: “I am not an anti-evolutionist or a Lamarckian. I think that Darwin was basically right, but . . .” and then goes on to point out the problems Darwin ignored.

The antidarwinism stance is a very sensitive one, because ultimately its dissatisfaction stems from the same inadequate explanations that fuel creationism. Creationists and dissenting evolutionists differ in a fundamental way, however, in that while the evolutionists celebrate change over time while searching for more refined mechanics behind it all, creationists specifically challenge the notion of significant change by any

means. The demerits which any taint of creationism can bring to a scientific reputation, coupled with the intimidating genius of Darwin, have kept all but the boldest iconoclasts from doubting darwinian theory in public.

Yet, at the slightest scratch, doubts about the official big picture of evolution surface in private conversations among scientists. Recently neodarwinism — the modern synthesis of Darwin’s natural selection and Mendel’s genetics — has been in a healthy turmoil over the large-scale dynamics seen in the fossil record. At the same time, challengers to neodarwinism have been standing up in a number of fields within and outside of biology. Microbiologists, geneticists, theoretical biologists, mathematicians, and computer

scientists are saying there is more to life than Darwin. They do not reject Darwin’s contribution; they want to move beyond it. They are the postdarwinians.

Unlike the creationists, the postdarwinians can’t offer a firm alternative, or even a firm divine story. They have circumstantial evidence that darwinism is less than the super-theory it is billed as. They roll out evidence as to why the theory fails. They point to interesting experiments that suggest alternatives. Mostly, they harbor strong scientific hunches of a new direction. But the postdarwinians have no overarching, falsifiable grand theory. In that sense, there’s no contest with darwinism, because at the very least, darwinian natural selection offers a tool: a grand force that works

weaknesses of darwinian theory than Darwin himself. As an example of trouble, Darwin volunteered the astounding multifaceted sophistication of the human eye. (Every critic of Darwin since has also used his example). The exquisite design of interacting lens, iris, retina, etc. seems to defy the plausibility of Darwin's "slight, incremental" chance improvements. As Darwin wrote to his American friend Asa Gray, "About the weak points I agree. The eye to this day gives me a cold shudder." The difficulty Gray had was imagining how any portion of an unfinished eye, a retina without lens or vice versa, would be useful to its possessor. Since nature cannot hoard innovations ("Hey, this will come in handy in the Cretaceous!"), every stage in development must be immediately useful and viable. Even clever humans can't design in such a consistently demanding manner; breakthroughs have to work perfectly the first time. Therefore nature appears superhuman in its ability to create.

Imagine, says Darwin, that we extrapolate the tiny microevolutionary changes we see in domesticated breeding — a pea with extra-large pods made larger, or a short horse bred shorter. Imagine if we extend those slight changes caused by selection over millions of years, adding up all the minute differences until we see major change. This is what makes coral reefs and armadillos out of bacteria — accumulated microchange. Darwin asks that we extend the logic of microchange to cover the grand scale of Earth and Time. The argument that natural selection can be extended to explain everything in life is a *logical* argument. But human imagination and human experience know that what is logical is not always what is so. To be logical is a necessary, but insufficient, reason to be true. Every swirl on a butterfly wing, every curve of leaf, every species of fish is explained by adaptive selection in neodarwinism. There seems to be absolutely nothing that cannot be explained in some way as an adaptive advantage. But, as Rich-

ard Lewontin, a renowned evolutionist, says, "Natural selection explains nothing, because it explains everything."

The main problem with darwinian theory is that it is unproven. It is a startling hypothesis, first formulated in astounding detail by a genius, that seems to explain the major features of the biological landscape. The theory also seems to fit the fossil landscapes of the past in a rough way, and it seems to match the recently discovered mini-world of genetics and molecular apparatus. For all that, darwinism remains unproven in three ways: 1) the specific biological mechanics by which darwinism is supposed to proceed have not been worked out in sufficient detail (Darwin himself didn't even offer a guess); therefore 2) it is impossible to rule out the role of other forces working to produce similar effects in evolution. Until 3) evolution is duplicated under controlled conditions, in the wild or in a lab, darwinism remains untested. In that sense, darwinian evolution is more like history than science. Philosopher of science Karl Popper says bluntly that darwinism (or any current evolutionary theory) is not a scientific theory at all, since it cannot be falsified. "Neither Darwin, nor any Darwinian, has so far given an actual causal explanation of the adaptive evolution of any single organism or any single organ. All that has been shown — and this is very much [sic] — is that such an explanation might exist — that is to say, [these theories] are not logically impossible."

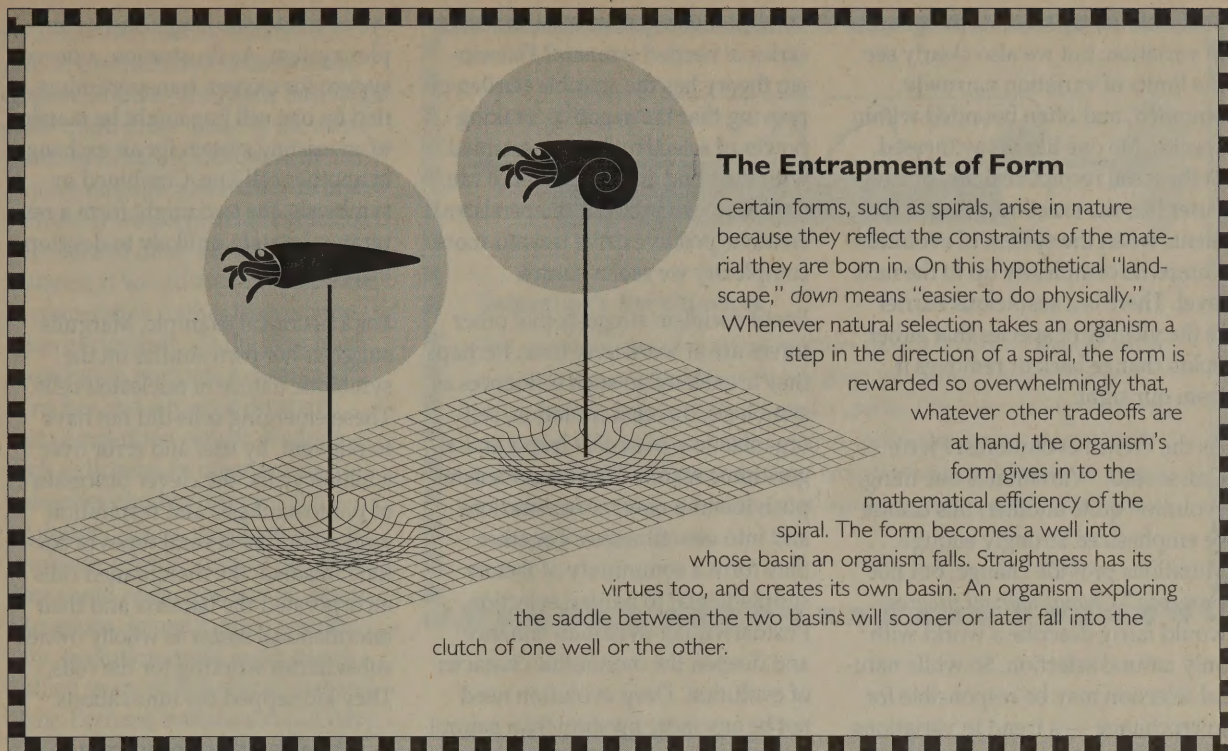
Postdarwinism

Lately, I've talked to theoretical biologists and read their papers and books. My doubts about the universality of darwinism are quite common, and old. Most heretical ideas in evolution have been explored by some respectable evolutionist of yesteryear. At the same time, I've been hanging around pioneering computerists, attending their conferences and reading their papers. I've

learned of their limited success in replicating nature as life or mind. The computationalists have shown us the true challenge, as well as the true difficulties, of conventional natural selection. A famous image from Darwin's *Origin of Species*, written over a century before the first computer contemplated $4 + 4$, precisely embodies the task of evolution in computerese: Evolution, Darwin said, "spends its hours scrutinizing the earth" for possible variations that work. This is none other than the algorithmic search, which lies at the very heart of computer science — the computational search for possible answers.

My interests in nondarwinian evolution processes began as I came to see that the methods the computationalists were exploring could be thought of as varieties of evolution. For the most part, the "scrutinizing" methods that computer hackers were madly pursuing were ignored by biologists. Most surprisingly, alternative approaches in both biology and computer science converged to a lively perspective — that of extrabiology, artificial life, synthetic ecology, radical evolution — in short, one side of postdarwinism. To the utter scorn of naturalists, the major impetus for this postdarwinian convergence comes not only from a few maverick biologists, but also from mathematicians, physicists, computer scientists, and whole systems theorists — people who couldn't tell the difference between *Cantharellus cibarius* and *Amanita muscaria* if their lives depended on it.

Postdarwinism is not about the denial of evolution, nor the demise of natural selection. Accumulative, continual change — however one wishes to define that — is beyond doubt (at least mine) at the core of biology and, further, of all modern thought. Darwin was mostly right, as far as he went. He merely didn't go far enough. Postdarwinism, as I present it here, is not creationism, nor raw Lamarckism, nor mysticism. Postdarwinism is a gathering of some mechanisms beyond natural selec-



The Entrapment of Form

Certain forms, such as spirals, arise in nature because they reflect the constraints of the material they are born in. On this hypothetical "landscape," down means "easier to do physically."

Whenever natural selection takes an organism a step in the direction of a spiral, the form is rewarded so overwhelmingly that, whatever other tradeoffs are at hand, the organism's form gives in to the mathematical efficiency of the spiral. The form becomes a well into whose basin an organism falls. Straightness has its virtues too, and creates its own basin. An organism exploring the saddle between the two basins will sooner or later fall into the clutch of one well or the other.

tion thought to drive evolution in ways that natural selection alone cannot. If there is a motto, it should be "Natural selection is not enough."

The Second Example

Classical evolutionary theory is wrapped up in the dilemma of having only one example, happening chiefly in the past, and being, by definition, imperceptible to observation because of its slowness and slowness. Without a second example of evolution, it becomes immensely difficult to present it in a form that is falsifiable.

Computer models of life, so realistic that researchers optimistically call them artificial life, are the first hope of a second example of evolution. The holy grail of artificial-life researchers is self-perpetuating, autonomous creatures growing and evolving in coevolutionary habitats. For the foreseeable future, that dream will be a bust. But in their quest to build ever more lifelike models, a-life researchers will prob-

ably settle many of the unproven issues of evolution — technical points such as the limits of natural selection, the reliability of fossil records, the necessity of isolation for speciation. Because they are not setting out to fix biology and don't give a hoot whether Darwin was right or wrong, the computerists can ask, and (somewhat) answer, the questions no one else will — like, What if death is capricious? Or, What if there was sex from the beginning? Or, What if there were no extinctions? Biologists will fight it, but in the end persuasive proof or disproof of darwinism, and a second example of life, will both come from this unlikely abiological source.

So far, the bet would have to be that computers disprove the monopoly of darwinism. All around the world, long-term observations of evolving populations in the wild continue: snails in Tahiti, fruit flies in Hawaii, finches in the Galapagos. Every year that these studies go on, there is a better chance that scientists can unequivocally demonstrate long-term

evolution in action in the field. Shorter-term studies using bacteria, and recently meal moths, show interesting results in the lab. One can thus demonstrate — in the wild, on farms, and in computers — that one can get emergent change by summing up the steady work of incremental deletions of the unfit.

But so far, all the evidence points to severe limits for this extrapolated microchange. Despite the ongoing studies of living animals evolving their forms, we have witnessed no new species' emergence in the wild in recorded history. Also, most remarkably, we have seen no new animal species emerge in domestic breeding. That includes no new species of fruitflies in hundreds of millions of generations in fruitfly studies, where both soft and harsh pressures have been deliberately applied to the fly populations to induce speciation. And in a-life, where the term "species" does not yet have meaning, we see no cascading emergence of entirely new kinds of variety. In the wild, in breeding, and in

artificial life, we see the emergence of variation; but we also clearly see the limits of variation narrowly bounded, and often bounded within species. No one has yet witnessed, in the fossil record, real life, or computer life, the exact transitional moments when the system of evolution pumps its complexity up to the next level. There is a suspicious barrier in the vicinity of species that either holds change back or removes it from our sight.

As the French evolutionist Pierre Grasse said, "Variation is one thing, evolution quite another; this cannot be emphasized strongly enough. . . . Mutations provide change, but not progress." *Change without progress* would fairly describe a world with only natural selection. So while natural selection may be responsible for microchange — a trend in variations — no one can say undisputedly that it is responsible for macrochange — the creation of an unexpected novel form and progress toward increasing complexity.

Most critics of natural selection concede that Darwin got "survival of the fittest" right. Natural selection means the destruction of the unfit. Once fitness is created, natural selection is peerless for winnowing out the duds. But creating something useful is the bugaboo. What darwinian theory neglects is a plausible explanation for the origin of fitness. Where does fitness come from before it is selected? In the popular rendition of darwinism today, the origin of fitness is credited to random variation. Random variation in the gene produces a random variation in the developmental growth of the organism, which every now and then bestows increased fitness on the whole organism. Fitness is generated randomly.

The question comes down to whether random variation is sufficient to produce the steady line of successes that neodarwinism demands. Given that natural selection weeds out all the uncountable failures, and that there is uncountable time, can ran-

dom mutation generate the unbroken series of needed winners? Darwinian theory has the sizeable burden of proving that the negative, braking power of selective demise, coupled with the blind chaotic power of randomness, can produce the persistent, creative, positive drive toward more complexity we see in nature.

Postdarwinism suggests that other forces are at work over time. Perhaps they are related to such influences as symbiosis, directed mutation, self-organization, plausible leaps, and algorithmic search. These mechanisms push life into new reorganizations and into new fitnesses. Together they form a community of factors supplemental to natural selection. Postdarwinian dynamics enhance and deepen the monolithic character of evolution. Deep evolution need not be any more mystical than natural selection is. Each alternative evolutionary force that I know about attempts to bolster the wimpy, creative side of natural selection. Think of each dynamic — symbiosis, directed mutation, hopeful monsters, self-organization, the algorithmic search — as a mechanism that will foster evolutionary innovation in a more realistic way, and better complement Darwin's ruthless selection.

Symbiosis

Symbiosis — the merger of two organisms into one — was once thought to occur only in isolated curiosities like lichens. After Lynn Margulis postulated bacterial symbiosis as a central event in the formation of the ancestral cell, biologists found symbiosis popping up frequently in microbial life. Since microbial life is (and has always been) the bulk of all life on earth, widespread microbial symbiosis makes symbiosis fundamental, both in the past and in the present. In contrast to the traditional picture of a population seething with tiny, random, incremental changes in their routine until they hit upon a stable new configuration, Margulis would have us consider the accidental merging of two working simple

systems into one larger, more complex system. As illustration, a proven system for oxygen transport inherited by one cell line might be married to an existing system for air exchange in another cell line. Combined in symbiosis, the two might form a respiratory system unlikely to develop incrementally.

For a historical example, Margulis suggests her own studies on the symbiotic nature of nucleated cells. These emerging cells did not have to reinvent, by trial and error over a billion years, the clever processes of photosynthesis and respiration worked out by several types of bacteria. Instead, the membraned cells incorporated the bacteria and their informational assets as wholly owned subsidiaries working for the cells. They kidnapped the innovations.

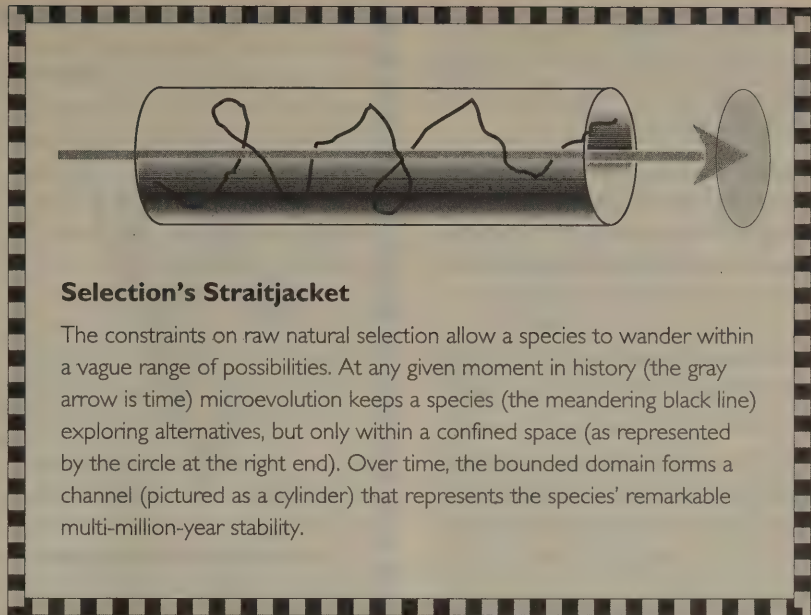
In some cases the genetic strands of two symbiotic partners may fuse. One proposed mechanism for the informational coordination needed for this kind of symbiosis is the known intercell gene transfer, which happens at a terrific rate among bacteria in the wild. The know-how of one system can be shuttled back and forth between separate species. A new bacteriology views all the bacteria of the world as a single genetically interacting beast that rapidly absorbs and broadcasts genetic innovations among its members. Interspecies gene transfer also occurs (at an unknown rate) among more complex species, including humans. Species of every sort are constantly swapping genes, often with naked viruses as the messengers. Viruses themselves are sometimes taken in symbiotically. A number of biologists believe that large chunks of human DNA were inserted viruses.

If true, the symbiotic nature of a cell provides a couple of lessons. First, it gives an example of a significant evolutionary change that lessens immediate benefits to the individual (since the individual disappears), in contradiction to darwinian dogma. Second, it gives an example of evolutionary change that is not amassed

by slight incremental differences, also in contradiction to darwinian dogma. Routine symbiosis on a large scale could drive many of the complexities in nature that seem to require multiple simultaneous innovations. It would provide evolution with several other advantages; for instance, it would exploit the power of cooperation, rather than competition exclusively. At the very least, cooperation nurtures a distinct set of niches and a type of diversity that competition cannot produce — such as lichens. In other words, it unleashes another dimension in evolution. Also, a small amount of symbiotic coordination at the right time could replace an eon of minor alterations. In one mutual relationship, evolution could jump past a million years of individual trial and error. Perhaps evolution could have discovered nucleated cells directly, without symbiosis, but it might have taken another billion years, or five, to do so. Lastly, symbiosis recombines widely diverse know-how separated in life's divergent genealogy. The picture to keep in mind is the diagrammatic tree of life, with ever-dividing, ever-spreading branches. Symbiotic alliances bring divergent branches of the tree of life together again, to intersect. Evolution, charted with symbiosis included, may resemble a briar patch more than a tree — the Thicket of Life. If the Thicket of Life is sufficiently tangled, it may require a rethinking of our past and future.

Directed Mutations

Natural selection is a very grim natural reaper. Darwin made the bold claim that, at the very heart of evolution, many small deletions in bulk — many small wanton deaths — feeding on the throwaway optimism of minor variation, could, in a counterintuitive way, add up to something truly new and meaningful. In the drama of traditional selection theory, death plays the star role. It works singlemindedly by attrition. It is an editor that knows only one word: No. Variation counterbalances



Selection's Straitjacket

The constraints on raw natural selection allow a species to wander within a vague range of possibilities. At any given moment in history (the gray arrow is time) microevolution keeps a species (the meandering black line) exploring alternatives, but only within a confined space (as represented by the circle at the right end). Over time, the bounded domain forms a channel (pictured as a cylinder) that represents the species' remarkable multi-million-year stability.

the one-note song of death by giving birth to the new in cheap abundance. It too knows only one word: Maybe. Variation cranks out disposable maybes in bulk, which are immediately mowed down by death. Bulk mediocrity is dismissed by wanton death. Occasionally, the theory goes, this duet produces a Yes! — a starfish, kidney cells, or Mozart. On the face of it, evolution by natural selection is still a startling hypothesis.

Death gives room for the new, it eliminates the ineffective. But to say that death causes wings to be formed, or eyeballs to work, is essentially wrong. Natural selection merely selects away the deformed wing, the unseeing eye. "Natural selection is the editor, not the author," says Lynn Margulis. What, then, authors innovation in flight and sight?

Evolution theory, from Darwin on, has had a dismal record in dealing with the origin of innovation. As his book title made clear, the question of the origin of *species* was the great riddle Darwin hoped to solve, not the origin of individuality. Where did new *kinds* of creatures come from? Where variation among individuals came from was not something he addressed.

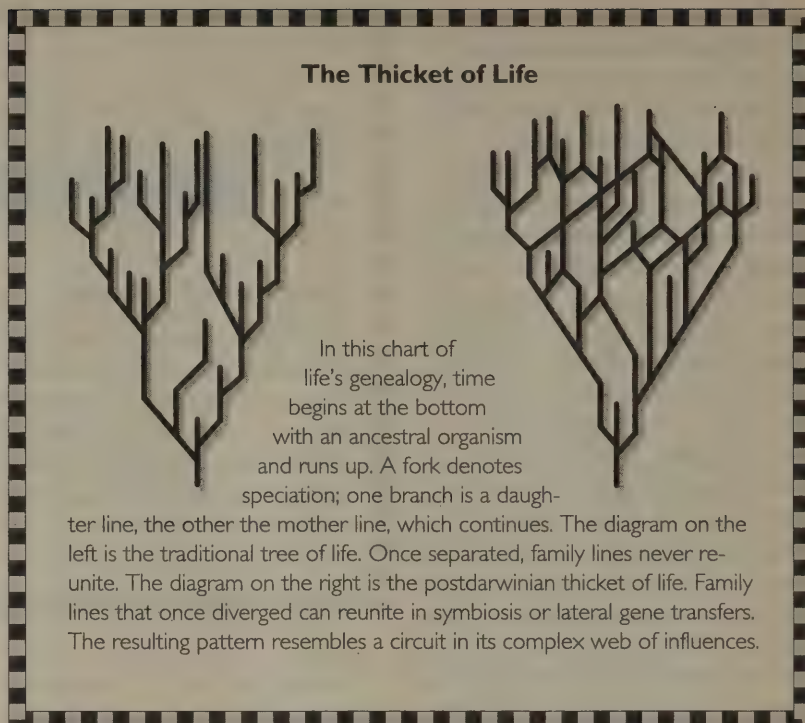
Genetics, which began as a distinctly separate field of science, did pay attention to variation and origin of innovation. Early geneticists like Mendel and William Bateson struggled with explanations of how variations arose and were passed on to descending generations. Sir Francis Galton showed that for statistical purposes — the main bent of genetics until bioengineering came along — the propagation of variation within populations could be considered to have a random origin. Later, when the mechanism for heredity was discovered to be a code of four symbols strung on a long chain of molecules, the random flip of a symbol at a random point on the thread was easy to visualize as a cause of variation and easy to model in mathematics. These molecular flips are generally attributed to cosmic rays or thermodynamic noise. A monstrous mutation, once implying freakish severity, was newly seen as simply a flip, a mere deviation from the average variation. It was not long before all variations in an organism — from freckles to cleft palates — were treated as statistical degrees of mutational error. Variation thus became mutation and "mutation" became inseparably compounded into

“random mutation.” Today, the term random mutation seems redundant: what other kind of mutation could there possibly be?

The exact nitty-gritty origins of mutations and variations are still uncertain. We do know this: variation is emphatically not due to random mutation — at least not always; it has some measure of order. This is an old idea. As early as 1926, C. Smuts gave this genetic self-control a name: internal selection.

The common scenario for internal selection allows the supposed randomness of cosmic rays to produce errors in the DNA code, which are then corrected by known self-repair apparatus in cells in a discriminate fashion — correcting some and passing others. There is a high energetic cost to the correction of errors, a cost which must be weighed against the possible benefit of the variations. If the error occurred where it is probably opportune, it stays; if it occurs where it is bothersome, it is corrected. For a hypothetical example, the Krebs cycle is the basic fuel plant in every cell of your body. It's worked fine for hundreds of millions of years. There is simply too little to gain, and far too much to lose, in fiddling with it now. When a variation is detected in the code for the Krebs cycle, it is quickly extinguished. On the other hand, body size and body proportions might be worth tweaking; let's leave that area open to variation. If this were how it worked, differential variation would mean that some randomness is “more equal” than others. One fascinating consequence of this setup is that a mutation in the regulatory apparatus itself could have a large-scale effect far beyond a mutation in the strings it governs. I'll get back to that later.

Because genes interact and regulate each other so extensively, the genome forms a complex whole that resists change. Only certain areas can vary at all because most of the genes are so interdependent upon each other — almost gridlocked — that variation is not a choice. As evolutionist



Ernst Mayr puts it, “Free variability is found only in a limited portion of the genotype.” The power of this genetic holism can be seen in animal breeding. Breeders commonly encounter undesirable side effects triggered when unknown genes are activated in the process of selecting for one particular trait. However, when pressure for that one trait is let up, organisms in succeeding generations rapidly revert to the original type, much as if the genome sprang back to its set point. Variation in genes is quite different than we imagined. Not only is it non-random, and parochial, but it is difficult to come by at all.

The evolutionary advantages of regulating mutation within localities of the chromosome are so convincing that most biologists accept it as a real possibility, even though watertight molecular proof is lacking. For one thing, it helps with the hoary problem of monkeys pounding on typewriters to produce a sonnet of Shakespeare. Instead, by the miracle of genetic coordination, the monkeys work on a sophisticated machine that only prints bona fide words when

the keys are hit. Change is confined among words rather than within words. This eases the strain of improbability somewhat for this still-improbable feat. The limits imposed by genetic regulators do the same for the gene: they reduce the importance of chance.

The impression one gets is of a highly flexible bureaucracy of genes managing the lives of other genes. Most astounding of all, the molecular evidence we have at hand shows that the same gene bureaucracy is franchised throughout life, from fruitfly to whale. For example, a nearly identical homeobox self-control sequence (a master-switch gene which turns hunks of other genes on) is found in every vertebrate.

So prevailing is the logic of non-random variation that I was at first flabbergasted by my failure to find any biologists working today who still believe mutations to be truly random. Their nearly unanimous acknowledgment that mutations are “not truly random” means to them (as far as I can tell) that individual mutations may be less than random

— ranging from near-random to plausible; but they still believe that statistically, over the long haul, a mass of mutations behaves randomly. “Oh, randomness is just an excuse for ignorance,” quips Lynn Margulis.

This weak version of non-random mutation is hardly even an issue anymore, but a stronger version is more of a juicy heresy. It says that variations can be chosen in a deliberate way. Rather than have the gene bureaucracy merely edit random variations, have it produce variations by some agenda. Mutations would be created by the genome for specific purposes. In a sense, the organism would direct mutations of its own making in response to environmental factors. Ironically, there is more hard

theory Jean-Baptiste Lamarck. Lamarck proposed a type of evolution in which changes acquired by an organism during its attempt to survive are passed on to its offspring. Say a giraffe stretches its neck to reach tree-top leaves that other giraffes can't. It passes that acquired character — a longer neck — on to its offspring, who now have an advantage. Because there has been little to no evidence of Lamarck's attractive theory, though many have tried to produce it, Lamarckism is a scientific no-no.

Another molecular biologist, Barry Hall, published results which not only confirmed Cairns' claims, but laid on the table startling new evidence. Hall found that his cultures of *E. coli* would produce needed muta-

have carefully eliminated all other explanations for their results, and stick by their claim that the bacteria are directing their own mutations. However, until they can elucidate a mechanism for the way in which a stupid bacterium can become aware of which mutation is required, few other molecular geneticists are ready to give up darwinism.

Hopeful Monsters

Although biologists are unconscious of it, there is another force at work preparing their receptivity to some kind of Lamarckian genetics. The force sits on their desks, inches from their minds: the unbiological miracle machine of a computer.

We are captives of our metaphors. The parallels of DNA and computer programming liberated biological inquiry from the worn ruts of Mendelian thinking. Now a cliché itself, the image of DNA as computer code breeds new traps. The myth of disembodied software is foremost among them.

The kind of software you load with floppy disks is straightforward. If you alter the code (for the better, you hope) and you “execute” the program, it behaves as it will. There is nothing between what the code is and what it does, except the wiring of the machine it runs on. Software has no body.

Biology is vastly different, though we tend to forget that. If we take a hypothetical hunk of DNA as software code, and alter it, there is a consequential body that must be grown before the effects of the alteration can manifest itself. The development of an animal from fertilized egg to egg producer may take years to complete; so the effect of that alteration can be judged differently depending on the stage of the growth. The same initial alteration of code can have one effect on the growing microscopic fetus and another effect on the sexually mature organism, if it survives that long. In every case, between the code alteration and the terminal effect

A new bacteriology views all the bacteria of the world as a single genetically interacting beast.

lab evidence at hand for the strong version of directed mutation than for the weak version.

According to the laws of neodarwinism, the environment, and only the environment, can select mutations; and the environment can never induce or direct mutations. In 1988 Harvard geneticist John Cairns and colleagues published evidence of environmentally induced mutations in the bacterium *E. coli*. Their claim was audacious: that under certain conditions the bacterium spontaneously crafted needed mutations in direct response to stresses in their environment. Cairns also had the gall to end his paper by suggesting that whatever process was responsible for the directed mutations “could, in effect, provide a mechanism for the inheritance of acquired characteristics” — a bald allusion to Darwin's rival-in-

tions at a rate about 100 million times greater than would be statistically expected if they came by chance. Furthermore, when he dissected the genes of these mutated bacteria by sequencing them, he found mutations in no areas other than the one where there was selection pressure. This means that the successful bugs do not desperately throw off all kinds of mutations to find the one that works; they pinpoint the one alteration that fits the bill. Hall found some directed variations so complex they required the mutation of two genes simultaneously. He called that “the improbable stacked on top of the highly unlikely.” These kinds of miraculous change are not the kosher fare of serial random accumulation that natural selection is supposed to run on. They have the smell of design. Both Hall and Cairns claim that they

(say, longer fingers), there is a chain of intermediate bodies governed by physics and chemistry — the enzymes, proteins, and tissues of life — which also must be indirectly altered by the software change. This vastly complicates mutational variation. Programming computers is no longer an adequate comparison.

You were once the size of a period. For a brief time you tumbled about as a multicellular sphere, much like pond algae. Currents swept and washed over you. Remember? Then you grew. You became sponge life, tubular, all gut. To eat was life. You grew a spinal cord, to feel. You put on gill arches, in preparation to breathe and burn food with intensity. You grew a tail, to move, to steer, to decide. You were not a fish, but a human embryo role-playing a fish embryo. At every ghost-of-embryonic-animal you slipped into, and out of,

you replayed the surrender of possibilities needed for your destination.

To evolve is to surrender choices. To move ahead is to accumulate all the things you can no longer be.

While evolution is inventive, it is also conservative, making do with what is available. Biology rarely starts over. It begins with the past, which is distilled in the development of the organism. By the time an organism arrives at the end of its natal development, the millions of trade-offs it has incurred forever block the chance to evolve in certain directions. Evolution without a body is limitless. Evolution with a body, wrapped in development and prevented from retreating by its current success, is bound by endless constraints.

To alter development early in the embryo is to fiddle with time. The earlier a mutation occurs in embryonic

development, the more forcefully it will resound through the organism. This also loosens the constraints against failure, so the earlier the mutation in development, the less likely it will be workable. In other words, the more complex an organism becomes, the less likely a very early change will survive.

Early developmental change has the advantage that a small mutation can affect a suite of things in a single blow. An appropriate early tweak can invoke or erase ten million years of evolution. The famous *Antennapedia* mutant of the *Drosophila* fruit-fly is an example. This single-point mutation engages the leg-making apparatus of the embryo fly to build a leg where its antenna should be. The afflicted fly is born with a fake foot sticking out of its forehead — all triggered by one tiny alteration of code, which in turn triggers a suite of

Bibliography and Further Reading

(There must be shelfloads of creationist literature, but I have read almost none of it, and include none here.)

Evolution: A Theory in Crisis. Michael Denton, 1985, New York: Burnett Books. *The best scientific critique of darwinian evolution available. If you want the technical reasons to doubt the party line, dig in here. Most highly recommended.*

Darwin on Trial. Phillip E. Johnson, 1991, Washington, DC: Regnery Gateway. *Johnson is a lawyer who treats neodarwinism as a defendant on trial, and subjects its evidence to the strict rules of court: "Look, all I'm saying is if you take the theory, subtract out the question-begging tautologies, and look at the evidence without assuming what you are trying to prove, what you have left is an unproven hypothesis that does not fit the evidence at hand."*

Beyond Natural Selection. Robert Wesson, 1991, Cambridge: MIT Press. *At times, this tome is a mere tedious cataloging of evidence and examples of*

nonselectionist evolution that reminds me of lists atheists make of "contradictions" in the Bible. At rare moments, it gets to the "so what" of it all. Still, I owe the late author a couple of key ideas.

The Great Evolution Mystery. Gordon R. Taylor, 1982, New York: Harper & Row. *Taylor treats evolution as an unsolved mystery and trots out both conventional darwinian explanations and conventional doubts about those explanations. A real skeptic of antidarwinism will need to proceed further via its good bibliography.*

Janus: A Summing Up. Arthur Koestler, 1978, New York: Random House. *No critic of Darwin in modern times has been as literate or influential as Koestler. He spends the latter third of this book summing up his objections to darwinism, and offering some suggestions for alternatives.*

Darwinism: The Refutation of a Myth. Soren Lovtrup, 1987, London: Croom Helm. *Detailed, blow-by-blow history of*

the ideas and personalities of anti- and nondarwinism. It goes deep into the doubts of other biological experts about darwinism.

The Heuristics of Nature: The Plausible Mutation of DNA. Douglas B. Lenat, 1980, Report No. HPP-80-27, Stanford Heuristic Programming Project. *The most original thinking on alternative theories to darwinian evolution that I know about is compactly presented in this report.*

Symbiosis as a Source of Evolutionary Innovation. Lynn Margulis and Rene Fester, eds., 1991, Cambridge: MIT Press. *This collection of recent papers addresses the topic of protracted and intimate associations of different species, particularly those with a heritable symbiosis — exchange of DNA information — as a means of unconventional (to theorists) evolution.*

Beyond Neo-Darwinism. Mae-Wan Ho and Peter T. Saunders, eds., 1984, London: Academic Press. *Not many nondarwinian books are published within science*

other genes. All kinds of monsters can be hatched this way. Which leads developmental biologists to wonder if the self-regulating genes of an organism might be able to tweak the genes governing these early suites into useful freaks, thus bypassing Darwin's *incremental* natural selection.

When two chromosomes recombine in sex they do so, not in nakedness, but clothed inside a gigantic egg cell. The overstuffed egg has a great deal of say in how the genes are implemented. The yolky cell is chock-full of protein factors and hormone-like agents, and controlled by its own nonchromosomal DNA. The egg cell directs the chromosomal genes as they begin to differentiate, guiding them, orienting them, and orchestrating the construction of their baby. It is no exaggeration to say that the final organism reproduced is partly under the control of the egg

cell, and out of the control of the genes. The state of the egg cell can be affected by stress, age, nutrition, etc. (There is one claim that Down's Syndrome, common in babies born to older women, happens because the two chromosomes responsible for the birth defect become physically entangled by lying so close to each other for so many years in the mother's egg cell.) Even before you are born — indeed from the moments of conception onward — forces outside of your genetic information form you *genetically*.

Hereditary information does not exist independently of its embodiment. The origin of an organism's inheritable body, or morphogenesis, is due then to a partnership of nongenetic cell material and hereditary genes — body and genes. Evolution theory, and in particular evolutionary genetics, cannot understand evolution in

full unless it remembers the complicated morphology of life.

Each egg cell, like most nucleated cells, carries several libraries of DNA information outside of the chromosomes. Most disturbing to standard theory, the egg cell may be constantly swapping bits of code within itself, between the files of its in-house DNA and the files of inherited DNA. If information in the house DNA could be shaped by the experience of the egg cell, then transmitted to the inheritable DNA, it would transgress the stern Central Dogma, which states that in biology information can only flow from the genes to the cellular body — not vice versa. That is, there is no direct feedback from the body (phenotype) to the gene (genotype). We should be suspicious of a rule like this, Arthur Koestler points out, because "it would be the only example found in nature

itself. This one comes from real biologists getting results that are suggestive of, or merely permit a hint of, nondarwinian evolution, though only a couple of scientists represented here would think of themselves as nondarwinians. This is good science.

Evolution at a Crossroads. D. J. Depew and B. H. Weber, eds., 1985, Cambridge: MIT Press. *Not explicitly antidarwinian, but a collection of scientific papers that explore radical approaches to the steep conceptual problems in evolution theory.*

The Problems of Evolution. Mark Redley, 1985, Oxford: Oxford University Press. *Here are the current bothersome problems in neodarwinian theory from within the perspective of neodarwinism. This book does not abandon the orthodoxy, but it does help clarify what the debates are about.*

Internal Factors in Evolution. Lancelot Law Whyte, 1965, New York: George Braziller. *An informed and bold speculation on the internal selection within the genome.*

Natural Selection and its Constraints. Oliver Mayo, 1983, London: Academic Press. *This extremely technical book treats genetic constraints on natural selection very seriously. Mayo asserts that constraints create narrow boundaries for evolution. He also dabbles with some alternative theories, which he woefully concludes cannot replace the current accepted theory.*

The Material Basis of Evolution. Richard Goldschmidt, 1940, New Haven: Yale University Press. *Consider this the prime source of the hopeful-monster theory. I know it primarily by reputation, and have not yet read the copy on my desk.*

Steps to an Ecology of Mind. Gregory Bateson, 1972, New York: Ballantine. *Longtime readers of this magazine will be familiar with this great book about the parallels between evolution and the mind.*

The Strategy of the Genes. C. H. Waddington, 1957, London: George Allen & Unwin Ltd. *The book that gave theoretical biology respect. Waddington*

wrestles with the influence of the gene's agenda upon evolution.

Natural Selection in the Wild. John A. Endler, 1986, Princeton: Princeton University Press. *Endler rounds up all known studies of natural selection in nature and dissects the methods and results rigorously.*

Unfinished Synthesis: Biological Hierarchies and Modern Evolutionary Thought. Niles Eldredge, 1985, Oxford: Oxford University Press. *Eldredge, who co-authored punctuated-equilibrium theory, here pushes evolutionary theory further in a pioneering work on hierarchies of evolutionary change. His perspective is strictly darwinian.*

Evolving Hierarchical Systems: Their Structure and Representation. Stanley N. Salthe, 1985, New York: Columbia University Press. *In very general terms, Salthe outlines the large-scale abstractions at work in evolving systems. This is a book about the cybernetics of evolution.* ☺

of a biological process devoid of feedback."

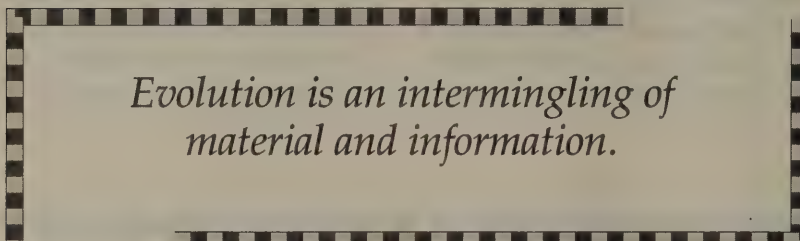
There are two lessons in morphogenesis. The first is that changes in an adult organism are triggered in embryos indirectly, through the environment of the mother's egg, as well as directly, by genealogy. There is plenty of room in this process for unconventional information flow from the cell (the mother's cell) to the genes, via control factors and via intracellular DNA swap. As German morphologist Rupert Riedl puts it, "Neolamarckism postulates that there is direct feedback. Neodarwinism postulates that there is no feedback. Both are mistaken. Truth lies

which it dwells. Goldschmidt spent an unrewarded lifetime showing that extrapolating the gradual transitions of microevolution (red rose to yellow rose) could not explain macroevolution (worm to snake). Instead, he postulated from his work on developing insects that evolution proceeded by jumps. A small change made early in development would lead to a large change — a monster — at the adult stage. Most radically altered forms would abort, but once in a while, large change would cohere and a hopeful monster would be born.

The hopeful monster would have a full wing, say, instead of the half-

evolutionary transitions can be accomplished at all."

There is a grave and unmistakable lack of intermediates in the fossil record. The fact that creationists gloat over it should not tempt others to ignore it. The "fossil gaps" were a hole in Darwin's theory that he promised would go away in the future, when more areas of the earth were searched by professional evolutionists. The gaps did not go away in the least. Once a "trade secret" of paleontologists, they are now acknowledged by every leading authority on evolution. Here are two: "The known fossil record fails to document a single example of phyletic [gradual] evolution accomplishing a major morphologic transition and hence offers no evidence that the gradualistic model can be valid," says Stephen Stanley, evolutionary paleontologist. And here's Steven Jay Gould again, speaking as the expert paleontologist he is:



Evolution is an intermingling of material and information.

in the middle. There is feedback but it is not direct." One major route for indirect feedback to the genes is the very early stages of embryonic growth, the hours of incarnation when the genes become flesh.

During these hours, the embryo is an amplifier. Hence the second lesson: Small changes can be magnified as development unfolds. In this way, morphogenesis skips darwinian gradualism. This point was made by the Berkeley geneticist Richard Goldschmidt, whose ideas on non-gradual evolution were derided and scorned throughout his life. His major work, *The Material Basis of Evolution* (1940), was dismissed as near-crackpot until Steven Jay Gould began a campaign to resurrect his ideas in the 1970s. Goldschmidt's title mirrors a theme of mine here: that evolution is an intermingling of material and information, and that genetic logic cannot be divorced from the laws of material form in

winged intermediate form darwinian theory demanded. Organisms could arrive fully formed in niches that a series of partially formed transitional species would never get to. The appearance of hopeful monsters would also explain the real absence of transitional forms in fossil lineages.

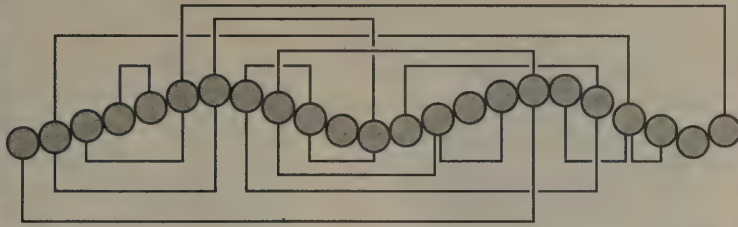
Goldschmidt made the intriguing claim that his hopeful monsters could most easily be generated by small shifts in developmental timing. He found "rate genes" that controlled the timing of local growth and differentiation processes. For instance, a tweak in the gene controlling the rates of pigmentation would produce caterpillars of wildly different color patterns. As his champion Gould writes, "Small changes early in embryology accumulate through growth to yield profound differences among adults. . . . Indeed, if we do not invoke discontinuous change by small alterations in rates of development, I do not see how most major

All paleontologists know that the fossil record contains precious little in the way of intermediate forms; transitions between major groups are characteristically abrupt. . . .

The history of most fossil species includes two features particularly inconsistent with gradualism:

1. Stasis. Most species exhibit no directional change during their tenure on earth. They appear in the fossil record looking much the same way as when they disappear. . . .
2. Sudden appearance. In any local area, a species does not arise gradually by the steady transformation of its ancestors; it appears all at once and "fully formed."

In the eyes of science historians, Darwin's most consequential claim was that the discontinuous face of life as a whole was an illusion. The separateness of species, the "immutable essence" intrinsic to each type of animal or plant — a principle which the ancient philosophers had taught forever — was, he claimed,



Genes in Gridlocked Cohesion

A string of regulatory genes in a chromosome is represented by shaded circles. Regulatory genes can turn a second gene on or off, or prepare another gene to be turned on or off. The second gene may in turn influence other genes, which may in turn indirectly influence the first gene. This tangle of controlling influences is indicated by control lines in the diagram, connecting one gene to another. In this hypothetical illustration the degree of connectivity is exaggerated to give the sense in which high connectivity "freezes" the chromosome in the current pattern. It's difficult for any gene introduced into, or removed from, the network to have much influence on the collective behavior of the gene string as a whole.

false. The Bible spoke of creatures "each made in their kind," and most biologists of the day, including the young Darwin, thought species kept to their breed in a idealized way. It was the type that mattered, while individuals conformed more or less to the type. The enlightened Darwin announced, however, that 1) every individual differed significantly; 2) all life was dynamically plastic, infinitely malleable between individuals, so 3) individuals arranged in populations were all that mattered. The barriers erected by species were porous and illusory. By shifting the discontinuity from species to every individual, Darwin vaporized it. Life was one.

But intriguing suspicions now accumulating in the study of complex systems, particularly complex systems that adapt, learn, and evolve, suggest Darwin was wrong in his most revolutionary premise. Life is largely clumped into parcels and only mildly plastic. Species either persist or die. They transmute into something else under only the most

mysterious and uncertain conditions. By and large, complex things fall into categories and the categories persist. Stasis of the category is the norm: the typical lifespan for a species is between one and ten million years.

Things that resemble organisms — economic firms, thoughts in the brain, ecological communities, nation-states — also naturally differentiate into persistent clumps. Human institution clumps — churches, departments, companies — find it easier to grow than to evolve. Required to adapt too far from their origins, most institutions will die.

"Organic" entities are not malleable because complex systems cannot easily be gradually modified in a sequence of functional intermediates. A complex system (such as a zebra or a company) is severely limited in the directions and ways it can evolve, because it is a hierarchy composed entirely of sub-entities, which are also limited in their room for adaptation because they are composed of sub-sub-entities, and so on down the tower.

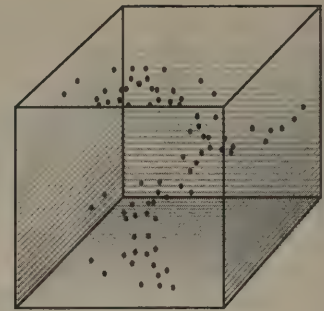
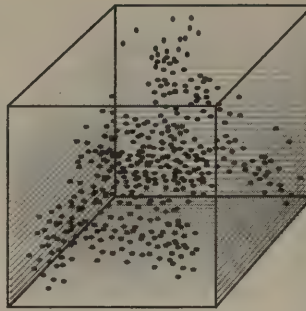
It should be no surprise, then, to find that evolution works in quantum steps. The given constituents of an organism can collectively make this or that, but not *everything in between* this and that. The hierarchical nature of the whole prevents it from reaching all the possible states it might theoretically hit. At the same time, the hierarchical arrangement of the whole gives it power to make some large-scale shifts. So a record of this organism would show it leaping from this to that. In biology, this is called saltationism (from the Latin *saltare*, to jump) and it is totally out of favor in professional circles. Mild saltationism was rejuvenated with interest in Goldschmidt's genetic hopeful monsters, but a complexity saltationism that would significantly leap over transitional forms is pure heresy at the moment. Yet the interdependent co-adaptations that constitute a complex being must produce quantum evolution.

Self-Organization

Morphogenic development is full of inherited baggage that constrains the possible variety of future descendants. In addition, materials that constitute bodies impose physical constraints that limit what kind of animals can be formed. There'll be no elephants with legs as thin as an ant's. Genetic constraints — the physical nature of genes — likewise narrow what kind of animals can be formed. Each bit of genetic information is a protein that must physically move to communicate. As general as DNA is, some messages will be difficult or impossible to code in a complex body because of the physical constraints of the genes. Because genes have their own dynamics independent of the organism, they restrict what can be birthed from them. Inside the genome, genes are interconnected to the point that the gene can become gridlocked — A is waiting on B, B is waiting on C, and C is waiting on A. This internal linkage raises a conservative force within the genome that pushes on itself to keep the genome unchanged —

Possibility-Space Notation

Introducing: a visual notation to render a simplified conceptual view of complex things. To plot something as complex as you, we could take, say, the five values of your height, weight, IQ, typing speed, and eyesight, make each one a dimension of an imaginary box, and then plot you (kind of) as a point in this five-dimensional space. For convenience's sake we visualize all dimensions greater than three as an easy-to-graph three. One of the first things to notice about the five-dimensional plot of you is that there are many places in the space of all possible yous (as we defined you here) that are essentially impossible. The point where you are two feet tall, 10 pounds, half-blind, and typing 165 words a minute is outlaw



area; it is not an option in real life. As we study the possibility space of you, we find that many options are simply not reachable in reality. If we were to shade in the space that represented feasibility, that area might claim only a small portion of the whole space. Some areas would be thick with real possibilities, some would be thin. It might be that, overall, there are more unfeasible options than feasible, in which case the

graph would look like the one on the right — possibility-sparse. Or it might be that feasible options are so common that they outnumber the options that are infeasible — that's the possibility-thick graph on the left. As a living organism changes its form over time, it slides from one feasible point to another in its "space," tracing a meandering line through the possibility space.

regardless of what body it makes. Like a complex system, the genetic circuitry tends to resist perturbations by restricting allowable variations. The genome seeks to persist as a cohesive unity.

An illustration of the gene's homeostasis is the way highly bred animals, such as exotic dogs or racehorses, rapidly revert to their wild form when left to breed freely. They devolve much more rapidly than they were bred, sometimes in a generation or two. In the lingo of physics, the feral genotype is an attractor that draws genes into its basin, a node created by self-organization.

When artificial or natural selection moves a genotype (say, of a pigeon) out of one stability toward a preferred character (say, white color) the interlinked character of the genome kicks in to produce multiple side effects, (say, nearsightedness). Darwin, pigeon breeder that he was, noticed this, and called it "the mysterious law of correlation of growth." Mayr

states, "I do not know of a single intensive selection [breeding] experiment during the past 50 years during which some such undesirable side effects have not appeared." The single point mutations that traditional population genetics are built upon are most likely a fantasy. Genes work in complexes, and are themselves a complex, adaptive system. The gene has its own wisdom.

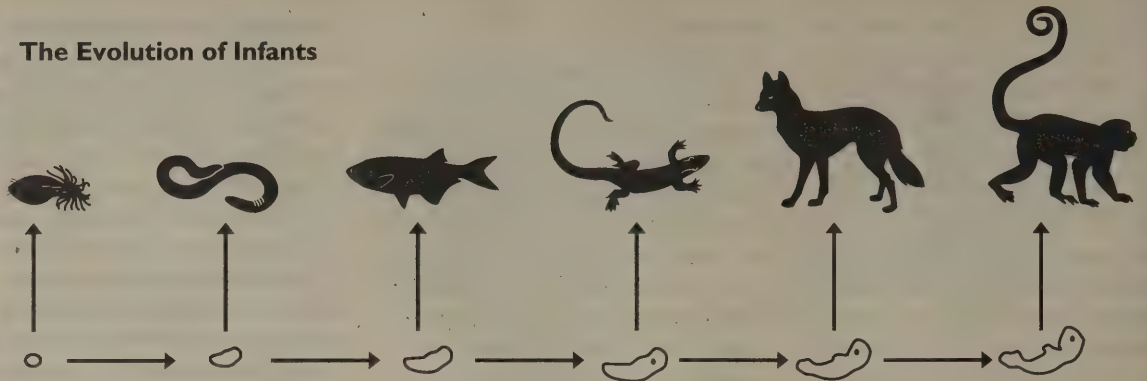
The genome must stray far enough from its usual arrangement before it can create a substantially different outward form. In order to remain stable outside the usual, the genome must materially reorganize its arrangements of proteins or patterns of linkage. In cybernetic terms, it must settle into a different basin of attraction, one that has its own unity and cohesion, its own homeostasis.

Before an organism is born, before it directly meets the natural selection of competition and survival, it has already been subjected to two degrees of internal selection — by the

genome and by the laws of bodily form. There is yet a third degree of internal selection that affects an organism before it can truly deal with natural selection. A change accepted by the genome, and then accepted by the bodily form, must then be accepted by the population at large. A single individual with a brilliant mutation will bury that innovation when it dies unless those genes are spread throughout the population. Populations (or demes) exhibit their own cohesive drive toward unity, contributing to an emergent behavior of the whole, as if they were one large, homeostatically balanced system — the population as an individual.

That anything novel ever surmounts these hurdles to evolve is astounding. Mayr writes, in *Toward a New Philosophy of Biology*, "The most difficult feat of evolution is to break out of the straight-jacket of this cohesion. This is the reason why only so relatively few new structural types have arisen in the last 500 million years,

The Evolution of Infants



In one model of evolution, rules of thumb guide both development and evolution. Evolutionary rules of thumb work on embryos, while developmental rules work on everything else thereafter. Hereditary genes develop software routines that suggest strategies such as "try keeping the body warm if you have four legs." Plausible guesses, rather than random guesses, move an organism from one form to the next (above). If successful, a rule of thumb is stored in the genes, and reenacted for each individual during development. The same script used during evolution unfolds during individual growth (below).



ates the universe. This brings us to its relevance to biology.

Scientists can view evolution as the path of an organism through a high-dimensional space of possibilities. As a typical primitive form evolves to a more complex form, it travels in the space from one point to another. Put into this language, the "problem" evolution scrutinizes is to find the next-nearest point for an organism that is within the feasibility zone of possibilities — to search for the next viable form in a twisty sea of nonviable failures. Each time a new variant of an old creature is born, evolution is trying a tentative answer to the problem. If the creature can survive, it is one right answer, although it may not be the best possible right answer. Evolution is probing the space of possibilities in order to discover a satisfactory answer. Some scientists see thinking and evolving as parallel

puzzles with an astronomically high number of possible solutions, of which only a few are "right." Thinking seeks an answer that works; evolution seeks an organism that works. The difficulty evolution has is the same difficulty minds have: how do you find the needle of a few right solutions in a haystack of wrong answers?

Until recently evolutionary theory has offered only the strategy of selected chance via natural selection — sooner or later brute selection will find a shape by trying all possible shapes; give it a billion years or so. The experience of some computationalists refutes this explanation as even remotely possible — exhaustive search will only be useful as part of more aimed searches. This model suggests that evolution may tap the inherent order in the world by using algorithmic search to reach viable

next-forms for organisms. It means that the path of evolution may be guided by "search" principles that tremendously reduce the amount of random wandering needed to find some form that works.

How might biological heuristics work? Computer modeler Doug Lenat offers this conjecture: "Nature began with primitive organisms and a random-mutation scheme for improving them. By this weak method the first primitive heuristics accidentally came into being. They immediately overshadowed the less efficient random-mutation mechanism, much as oxidation dominated fermentation once it evolved."

Lenat has a most imaginative articulation of the important role of heuristics in morphogenesis. In his model, a collection of rules acts as a program for evolving infants. They unroll an embryonic mammal from an em-

bryonic fish from an embryonic sea blob. One of the rules might be (using Lenat's example): "When you see the organism in state x , then gills are a good improvement." Another rule might fire much later, after subsequent development: "If the organism is in state y , then gills are no longer needed." Once a fetus develops as far as it can by evolutionary heuristics, maturity heuristics take over and guide the organism to maturity. The point is that the same heuristic guiding evolutionary development also guides fetal development.

In Lenat's words, "We are therefore postulating that the DNA contains not a blueprint for the finished product, but rather a *description* . . . of the changes that were made over the eons in the DNA, changes which led to the evolution of our species. We are saying that ontogeny is really recapitulating phylogeny in each individual embryo. Hence evolution and development are really the same process (being guided by heuristic rules) operating over very different time scales." There is no blueprint. There are only inherited annotations to the most flimsy script.

Because every creature alive today is linked back to the very first organism in an unbroken relay of information, every creature alive today (and every cell alive) carries historical traces of this chain of being. Thus DNA is a record of the immense organization devised by nature over four billion years. Perhaps the genome reads itself to get a sense of what has worked in the past. This history includes the genetic constraints of the past. A heuristic will not "see" organisms. It will only see code that worked in the past, or maybe the shadow of code that worked in the past. An organism's genome serves, in a very loose but nontrivial sense, as a crude map of the possibility space of organisms related to it. If heuristics are important, the organism as a whole will be more aware of itself than we normally assume. However, this historical space tends to emphasize the feasible aspects (those that have already panned out) rather

than the unthought-of. Still, a picture of the past works much as history works for a futurist — as a way of shaping up rough guesses about "where next?" The hunches aren't accurate, and they are often wrong, but they are a hundredfold better than random trial and error. A heuristician's motto is: anything to narrow the search.

The evidence in real genes is nil. We know so little about coordination genes that we wouldn't know heuristical genes if they bit us on the nose. My hunch is that building a viable organism by natural selection is more troublesome than building a heuristic by natural selection to guide the organism-building. But imagine if the heuristic was not created by natural selection alone, but with the aid of an earlier heuristic! Consider the evolutionary advantage of a general heuristic, a coded rule of thumb, that helped construct new heuristics that begat other more complex heuristics that begat others — the holy grail! Our minds may have evolved in similar logic — a program that discovered a program which can discover even more programs.

We know virtually nothing of the distribution of life in the possibility space of reality. It may be so sparse and un-pregnant with possibilities that there is only one living path through it — the path we are currently on. Or there might be broad highways that channel a number of paths into a few bottlenecks that all must cross — say, the resonant attractor of four legs, a tubular gut, five-digit hands. Or there may be a submerged bias, so that no matter where you start you eventually arrive on the shores of bilateral symmetry, segmented limbs, and intelligence of one kind or another.

These fruitful questions are being asked, not in biological terms, but in the language of a new science, the science of complex, adaptive systems, which embraces the recent discoveries of chaos theory, artificial life, neural nets, and distributed parallel

processing. When a new modified theory of evolution is announced, it will be written in this language. And it will be discovered not by a biologist, but by one of the new breed of computational thinkers.

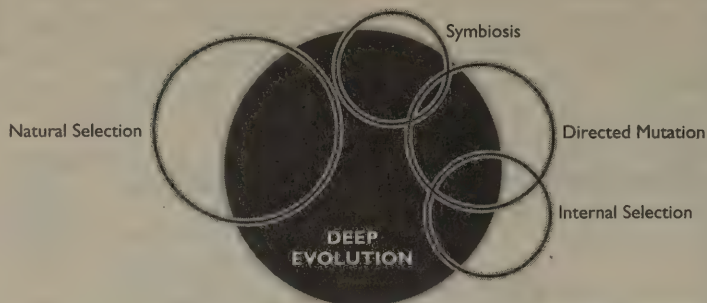
Deep Evolution

Darwin reminded readers in his update to the third edition of *Origin*:

As my conclusions have lately been much misrepresented, and it has been stated that I attribute the modification of species exclusively to natural selection, I may be permitted to remark that in the first edition of this work, and subsequently, I placed in a most conspicuous position — namely, at the close of the Introduction — the following words: "I am convinced that natural selection has been the main but not the exclusive means of modification." This has been of no avail. Great is the power of steady misrepresentation.

The least-appreciated aspect of natural selection is how unavoidable it is. The conditions for natural selection are very specific, but if these conditions are met, natural selection absolutely must occur! Natural selection can only occur in populations of things. The process must involve a population having 1) variation among individuals in some trait, where 2) that trait makes some difference in fertility, fecundity, or survival ability, and 3) where that trait is transmitted in some fashion from parents to their offspring. If those conditions exist, natural selection will happen as inevitably as seven follows six, or heads and tails split. As evolution theorist John Endler says, "Natural selection probably should not be called a biological law. It proceeds not for biological reasons, but from the laws of probability."

The conditions of natural selection are easily met in a computer. In the last few years, some long-haired graduate students have modeled natural selection in very sophisticated artificial life worlds on computers. This research has already unearthed



Varieties of Deep Evolution

A Venn diagram of the overlapping subsets of the varieties of evolution. Not all cases of internal selection or symbiosis or natural selection produce evolution. Nor is evolution only natural selection and symbiosis. Deep Evolution is the larger society of evolutions in interaction. While some varieties, like natural selection, are well known, many of the component parts of evolution as a whole are not yet named — indicated by the black region outside the small circles.

a growing body of nontrivial surprises. Yet artificial life suffers from the same malaise as its cousin, artificial intelligence (AI). No artificial intelligence that I am aware of — be it autonomous robot, learning machine, or massive cognition program — has run more than 24 hours in succession. After a day, AI stalls. Likewise, artificial life. Most runs of computational life fizzle out of novelty quickly. While the programs may keep running, and they may keep churning out minor variation, they ascend to no new levels of complexity or surprise after the first spurt (and that includes Tom Ray's world of *Tierra*; see page 21). Perhaps given more time to run, they would. (The first organic cell took billions of years. Patience, please!) Yet, for whatever reason, computational life based on unadorned natural selection has not seen the miracle of open-ended evolution that its creators, and I, would love to see.

Natural selection is not evolution, nor can evolution be equated with natural selection. In the same way,

arithmetic is not mathematics nor can mathematics be equated with arithmetic. One can claim that all of mathematics is just addition compounded. Subtraction is addition in reverse, multiplication addition in sequence, and all complex functions built upon those mere extrapolation of addition. This is somewhat the same argument of the neodarwinists: all evolution is the extrapolation of natural selection compounded. While there is a grain of truth in this perspective, it shuts off understanding and appreciation of more complex things. While multiplication is precisely a form of serial additions, wholly new powers emerge from this shortcut that would not be understood if multiplication was only thought of as addition repeated. Dwelling on addition will not get you to $E=mc^2$.

I believe there is a mathematics of life. Natural selection may be its additive function. But to fully explain the origin of life, the remarkable trend toward complexity, and the invention of intelligence, requires more

than addition. It needs a rich mathematics of complex functions built upon each other; it needs deeper evolution.

There is no such thing as monolithic evolution run by one-dimensional natural selection. It would be more fitting to say that evolution is plural and deep. Deep Evolution is an aggregate of many kinds of evolutions, one of which is natural selection. An uncharted variety of evolutions make up Deep Evolution, just as our minds comprise a society of dimwitted agents and a variety of types of thinking. Various evolutions proceed at different scales, at different tempos, in different styles. Furthermore, this blend of evolutions changes over time. Certain types of evolution were important in early proto-life, some are more emphasized now, four billion years later. One variety (natural selection) will be ubiquitous throughout the plurality, while others will be rare and specialized in their roles. Deep, pluralistic evolution, like intelligence, is an emergent property of a community of dynamics. As noted by the fierce darwinian critic Arthur Koestler, "The metaphor has shifted from the croupier at the roulette wheel to the conductor directing his orchestra."

Evolution is a multi-faced god, a creator with many arms, working by many methods, of which natural selection of variation is perhaps the common factor. But without the other brands of evolution on-line, natural selection is hobbled, and condemned to wander aimlessly within its own imposed limits. Natural selection is not enough, not by miles. It must be alloyed with more creative, generative processes to accomplish much. It must have more to naturally select from. The plurality required for the open-ended, complex, and rich life we see in our world comes from a deep evolution, multicolored, complex and changing itself over time. Poking into its secrets, and challenging the traditional story, are computer-toting postdarwinians. ☞

Desktop A-Life

Personal-computer owners will have two options when it comes to getting their hands on an artificial-life world. Mac users will be able to buy *SimLife*, from the folks that brought you *SimCity* and *SimEarth*. DOS users can get *Tierra*, the software developed by Tom Ray and discussed in "Artificial Life" (p. 22).

SimLife is a professionally polished program that runs on a Mac SE or better. The point of *SimLife* is to play with life in a way you can't (or shouldn't) in reality. According to its manual, the idea is to "build your own ecosystem from scratch," or to "stick your finger into an ecosystem, muck it up a bit and see what happens." What you fuss with are populations of software "simorgs" that replicate imprecisely, thus breeding variation and surprise. Naturally the simorgs interact in their computer geography, preying upon each other, or providing habitats

for growth, so that soon one has a miniature evolving ecosystem. Steering this seething mass of transforming things toward long-term stability is a very complex game. You drive it from a dashboard on the computer screen, full of knobs and buttons to tweak just about every parameter you'd like. Turn up the mutation rate, lower gravity, reduce sex. It's a bit corny, but *SimLife* will generate visual representations of the creatures evolving, in a mix-and-match way, like Mr. Potato Head. Although the publishers tout the program as a "software toy," it is in fact rich and deep enough to replace a college text on population genetics.

Tierra, the DOS program, is more abstract and less user-friendly. In fact, right now it is primarily a research tool without the niceties and refined graphics of a commercial game. One gets a bare, though powerful, engine to run model

ecologies of very simple organisms. You'll need a fair level of programming and hacking expertise to make *Tierra* any fun. On the other hand, *Tierra* offers a portal into a new biological territory, a wide-open frontier that a number of researchers are rushing into to stake claims.

The authors of both *Tierra* and *SimLife* have been too wrapped up in plugging leaks and squashing bugs in their software to have explored their own worlds very far or long. This is a wonderful time in the opening of artificial life: a discovery can come as easily from an amateur's explorations as from a pro's.

Tierra is most easily available as software downloaded from the author's university computer. It's free that way, and you'll get the most recent version. Or you can buy it on DOS disks (3.5" or 5.25" floppies) (see access). For instructions on how to download the software and receive electronic updates and announcements, email ray@brahms.udel.edu.

SimLife will be available on Mac disks, with a beefy manual that is its own course in evolutionary biology.

—Kevin Kelly

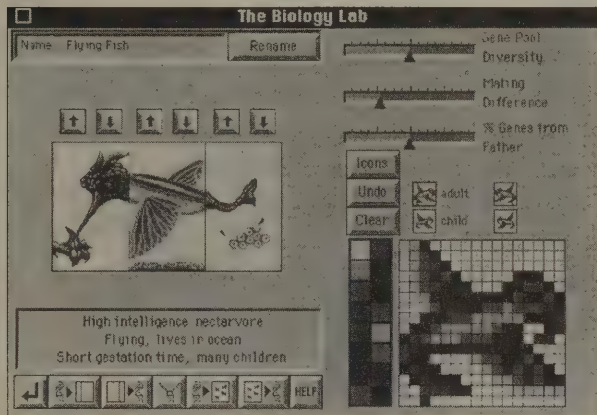
Using a variety of tools, the user can control details such as genetic makeup, environmental needs, and reproductive systems.

SimLife

Available in December from Maxis, 2 Theatre Square/Suite 230, Orinda, CA 94563-3346; 800/336-2947

Tierra

\$65 from Virtual Life, P. O. Box 625, Newark, DE 19715



An enlarged *SimLife* flip-card screen.

The "flip-card" in the *Biology Lab* allows the user to employ a mix-and-match method of customizing the new "species" that has been created.



"Virtual life is out there, waiting for us to create environments for it to evolve into."

—Tom Ray

Meat evolution is designing its way out of existence. The billion-year process that shaped us out of organic compounds is going to shape, on a vastly faster time-scale, the silicon life forms a few computational biologists plan to create in the near future.

Some people think tinkering with the pace of evolution might not be a bad idea. Who are we to question the way evolution works? Isn't human-engineered a-life a legitimate evolutionary mechanism? Once there were plankton, now there are people; tomorrow, it will be the semimetallic descendants of today's a-life experiments. Others argue that deliberately designed information creatures are something we have control over, unlike most evolutionary products, and we haven't created true a-life yet. A-lifers seem convinced that a sufficiently intelligent a-life will appear within the next five to ten decades, but they all agree that it hasn't happened yet. We might still have control over it.

Maybe Mary Shelley and a thousand horror movies were right, and there are some forces we ought not monkey with. Playing with death is one thing. Deliberately turning up the crank on the pace of evolution is in another league. Whatever we decide to do about creating or not creating possible successors, humans ought to make that decision before we lose control of the process we started. And that's where a good technology journalist comes in: if we are going to talk intelligently about where a powerful new technology might lead, we have to understand what it is.

Steven Levy wrote about the heroes of the personal-computer revolution in Hackers: Heroes of the Computer Revolution (EWEC p. 354). For several years, he has been tracking a brand-new science as it has emerged, the Santa Fe-centric world of a-life research. Levy talked to the key leaders of the a-life world, Chris Langton, Doyne Farmer, Norman Packard, John Holland, Danny Hillis, Thomas Ray. Right now, this young, hubristic discipline is bubbling with activity, and Levy gives us a clear look at it. He makes the complexities understandable, and in the process shows how the secrets of evolution are potentially more powerful than the force at the heart of atoms. It might have been like this if one had been able to read, at the very time it was occurring, the secret account of a detached observer who talked with Oppenheimer, von Neumann, Fermi, and the others who assembled in Los Alamos half a century before it became an a-life Mecca.

The following excerpt from Artificial Life: The Quest for a New Creation (Pantheon, 1992) is about the work of Thomas Ray, who uses biological tools to make computers do amazing tricks. Ray found a way to use the evolutionary processes of selection in a computer simulation to create new kinds of software. In fact, Ray has made available a personal computer version of Tierra (see Kevin Kelly's review, p. 21) — desktop a-life! To Ray, harnessing evolutionary mechanisms as a way to create software was also a way to create software capable of evolving life. Welcome to the mind of a man who would be as a god. —Howard Rheingold*

* See p. 142 for ordering information from the Whole Earth Bookstore.

ARTIFICIAL LIFE

THE QUEST FOR A NEW CREATION

BY STEVEN LEVY



Illustrations by Jim Woodring

A BIOLOGIST NAMED THOMAS RAY has devised what he believes to be the first truly open-ended digital evolution system. To Ray, allowing the system to find its own fitness — a natural selection as opposed to an artificial one — was key to creating living things on the computer. Ray's own definition of life hinged on that factor: "I would consider a system to be living if it is self-replicating, and capable of open-ended evolution . . ." he wrote. "Artificial selection can never be as creative as natural selection. . . Freely evolving creatures will discover means of mutual exploitation and associated implicit fitness functions that we would never think of."

Ray's interest in the field was not that of a digital alchemist but of

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*Artificial Life: The
Quest for a New
Creation* by Steven
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a professional biologist. Although he studied chemistry at Florida State University and had been planning to take further undergraduate work in physics and math, Ray became interested in ecology, "sort of in the sixties frame of mind," he explains, somewhat sheepishly. He completed a doctorate in biology at Harvard, and did fieldwork in the rain forests of Costa Rica. But one particular experience from his Cambridge days settled into his mind like a dormant spore. Ray had taken an interest in the Chinese game of Go, and one day in the late 1970s he was the recipient of a remarkable one-on-one deconstruction of the ancient game, from a beak-nosed, ponytailed hacker working at MIT's Artificial Intelligence Lab. To Ray's astonishment, this person coolly analyzed the game in biological terms, matter-of-factly mentioning that computer programs could self-replicate. Ray instantly made the connection between self-replication and natural selection and became very excited at the implications.

At the time, Ray's computer experience was insufficient to experiment with the concept. And soon, the pressures of his subsequent passion, rain forest conservation, took precedence. It was not until late in 1989, when Ray had become an assistant professor at the University of Delaware, that the spore revived. Ray had become familiar with the workings of personal computers, and he also followed the news of computer viruses. For some reason, the words of the mystery Go player tumbled back into his head. Could computer viruses be included among the potential life forms the hacker had postulated? Could he exploit these possibilities to perform a digital form of the Darwinism he had studied so closely this past decade? Ray became determined to find out.

No one else at Delaware was much interested. When Ray

brought up the idea at a graduate seminar in ecology, "I was virtually laughed out of the room," he says. Ray's colleagues, who had previously voted him down for tenure, considered the premise wacky. But Ray persisted. Although he had a grant to study tropical ecologies, he neglected the project. Instead he hatched ideas for techniques of stimulating evolution. "It was something that was obsessing me, and I felt I had to go where the flow of my energies were," he says. "Artificial life was the thing that kept me awake at night."

Wondering whether others were similarly impassioned, he posted an inquiry on various computer networks and was led to the proceedings of the first artificial-life conference. They galvanized Ray. He arranged to go to New Mexico to visit Langton, Farmer, and the other T-13 a-life researchers to discuss his idea for an open-ended evolutionary system.

It was a good thing he did. Ray's idea had been to create creatures consisting of computer instructions who would "live" inside the machine's core memory and compete for space in that silicon terrain. A potentially treacherous plan. Although Ray planned to run his experiment in an isolated personal computer labeled "containment facility" and protected with metal bars covering the disk drive and serial port, there was no guarantee that, through negligence or sabotage, his creatures would not be transferred to other computers. If for instance they found their way into one of the time-sharing mainframes on the Delaware campus, they could infect other jobs working on the computer or even migrate from that machine to the data highways of the international computer network. Ray's experiment could have been the equivalent of importing a deadly predator to an ecology that had evolved no protection against such an invader. It could be even more destructive

than the notorious "Internet Worm" loosed on the computer nets in November 1988 by a mischievous Cornell student — almost exactly a year before Ray's trip to Los Alamos. Unlike the comparatively primitive worm, Ray's organisms would be constantly evolving. Natural selection would favor those organisms most difficult to eradicate, and, like certain insects immune to DDT, mutated variations of Tom Ray's experiment might become permanent, and unwelcome, residents on the computer nets.

Langton and Farmer suggested a modification, based on Turing's perception that any digital computer could emulate any other digital computer. They suggested, in effect, that Ray should create an imaginary computer and simulate its operation within a real computer. That way, his organisms, in their competition for memory space in a virtual computer, could use a nonfunctional computer language, one that worked only in the model. If someone attempted to liberate the creatures and use them outside this theoretical cage, the code would not work.

Langton and Farmer warned Ray not to expect too much from his experiment. Ray's ideas of open-ended evolution depended on the creation of viable creatures whose subsequent mutations would drive the system toward a diverse set of more complex creatures. Mutations, however, were more often destructive than beneficial. Although natural organisms, with built-in redundancy, can accommodate occasional mutations, computer programs generally cannot. Non-open-ended simulated evolution systems such as GAs algorithms and Dawkins-style biomorphs avoided this problem by having an outside force weeding the population by a predetermined definition of fitness — a neat way to sweep away poorly mutated organisms. Because an open-ended system

"It was something that was obsessing me, and I felt I had to go where the flow of my energies were. Artificial life was the thing that kept me awake at night."



found its own fitness, Ray would not have that advantage.

But Ray thought he knew the way around the problem. Again, the virtual computer concept was the hero. Because an imaginary computer's machine-language requirements could be made much less exacting than those of a real computer, Ray could devise a specialized use of a computer instruction set that would be more forgiving to mutations. The scheme relied on using what Ray called "electronic templates." These were small blocks of computer instructions contained in each organism; replication occurred when the organism found the opposite template in the environment. Because the environment was well stocked with potential matching templates, even mutated organisms with altered instruction blocks could

easily reproduce. In addition, when an organism searched for complementary templates it was in effect examining its environment. Thus Ray's digital organisms had the equivalent of sensory apparatuses. By searching their environment for matching parts, Ray's creatures behaved in the spirit of von Neumann's imaginary kinematic self-reproducing automaton.

As soon as Ray returned to Delaware, he began creating the artificial environment he would call Tierra. Previous work in open-ended artificial evolution focused on the origin of life in an attempt to evoke the behavior of biology from a prebiotic environment. The archetypical example was the VENUS simulator, codesigned by Steen Rasmussen, the Danish physicist who was part of the Los Alamos T-13 group. Although

Ray considered VENUS interesting, he felt that it was unnecessary to begin so early in biological history. "It's based on the physics mentality — the Los Alamos guys want life to evolve virtually from quarks!" he says, the dismissive hyperbole underlying his conviction that his approach is superior. "They want to start with fundamental particles and get life to emerge spontaneously, at the origin-of-life level. What they get are more like molecules than chemistry. There's no individuality. It's a far cry from organisms."

Ray modeled his system on a later stage in life's development, the explosion of biological diversity that signaled the onset of the Cambrian Era, roughly six hundred million years ago. From a relative paucity of phyla, the earth teemed with unprecedented new life forms. Ray believed that

his system's exploitation of open-ended evolution, if not providing a similar profusion, would demonstrate the mechanics of that diversification.

The Tierran system was a competition for computer processing time and memory space. Whereas natural organisms drew energy from the sun to maintain their order, the digital organisms within the Tierran environment drew their energy from the virtual computer's central processing unit (CPU) and used that energy to power the equivalent of their own energy centers, virtual CPUs assigned to each organism. The components of the virtual computer — CPU, memory, and operating-system software — were the environment, and the digital creatures themselves were assembly-language programs that ran on the computer. (Assembly language consists of digital instructions read directly by a computer's central processor.) Like many other digital creatures, the code of Tierran organisms acted both as a genotype, in that the code was copied during reproduction, and as a phenotype, in that the execution of the program performed a function that determined its fitness. Typically, executing the code would cause a creature to be copied from one part of the environment to another. Cell division, or replication, occurred when the move resulted in a daughter cell that required its own slice of CPU time. Essentially, Tierran organisms were genetic replication machines, digital kin to the hypothesized RNA-world life forms that supposedly were the ancestors of all known subsequent forms of life.

All this took place in a block of computer memory that Ray referred to as "the soup." The creatures living in the soup were arranged in a circular queue, lined up to receive their slice of time from the virtual computer's CPU. A function Ray called the "reaper" made sure the soup did

not stagnate and policed the population by lopping off the creatures at the top of a separate, linear, "reaper queue." These were generally the oldest, which climbed up the list simply by aging. However, by successfully executing instructions, organisms could postpone their climb and thus fend off the reaper. Flawed creatures rose quickly up the queue and reached their fatal peaks after a short existence. But even relatively fit creatures could not permanently stave off their rise toward death because newcomers constantly were introduced below them. In Tierra, as on earth, death was inevitable.

Evolution in Tierra was driven by several methods of mutation. First, the soup itself was subject to noise — random bit-flipping that Ray considered "analogous to mutations caused by cosmic rays." (This insured the demise of even superbly adapted creatures, whose high fitness eventually would be worn down by the background bit-flipping.) Ray also implemented mutations during the replication process in order to emulate genetic variation. Finally, there was a form of mutation that sometimes caused random alterations of instructions when the creatures executed their code. The cumulative effect of all these mutations was to vary the Tierran environment and the evolution of its inhabitants each time the program was run; thus Tierra was not a deterministic system but a probabilistic one.

For two months Ray programmed furiously, and soon after New Year's Day 1990 he was ready to begin the test runs of Tierra on the high-powered Toshiba laptop he used for development.

The first time Ray ran Tierra, he did not expect much. "The Los Alamos people had told me it was going to be really hard to do what I wanted, that it would take years of work," he recalls.

"I believed that. They told me it

wouldn't work with the type of instructions I used, because they're too brittle, mutations would stop the system. I believed that, too, but I wanted to try it, as Chris Langton put it, to find out why it wouldn't work. So when I first ran the system I just wanted to get it working. I figured out how many instructions it would require to replicate, rounded it off, and that was my instruction set. Then I built a creature to test the simulator, a creature that self-replicated and didn't do anything else. I thought, 'Okay, I'll get the simulator working, and it'll take me years to get evolution out of the system.'

"But as it turns out, I never had to write another creature."

On January 3, working at night on a table in the bedroom of his apartment while his wife slept, Ray "inoculated" the soup with his single test organism, eighty instructions long. He called it the "ancestor." Its replications took somewhere over eight hundred instruction executions each time. The ancestor and descendants quickly populated the soup, until it was 80 percent full. Once that threshold was attained, the reaper began its grim task and ensured that the population would grow no further.

The experiment proceeded at twelve million instructions per hour. (Later, using more powerful computers, Tierra would run six times faster.) Ray tracked the proceedings on a dynamic bar chart, which identified the organisms and the degree to which they proliferated in the soup. Initially, clones of the ancestor dominated thoroughly; these typically replicated only once before dying. Then mutants began to appear. The first was a strain of creatures seventy-nine instructions long. The horizontal bar on the chart representing those creatures began to pulse, the bar representing the eighty-instruction ancestors shrank, and soon the lower bar

"The organisms have added a whole new realm to the fitness landscape, a new adaptation for passing on their genes, a specific mechanism not present in the ancestor. In this case, parasitism, or immunity to parasitism."

allowed them to reproduce while occupying less CPU time. (Ray had the option of adjusting the system parameters to reward larger organisms instead of smaller ones.)

Then something very strange happened. In the lower regions of the screen a bar began pulsing. It represented a creature of only forty-five instructions! With so sparse a genome, a creature could not self-replicate on its own in Tierra; the process required a minimal number of instructions — probably, Ray thought, in the low sixties. Yet the bar representing the population of forty-five soon matched the size of the previous largest creature. In fact, the two seemed to be engaged in a tug-of-war. As one pulsed outward, the other would shrink, and vice versa.

It was obvious what had occurred. A providential mutation had formed a successful parasite. Although the forty-five-instruction organism did not contain all the instructions necessary for replication, it sought out a larger, complete organism as a host and borrowed the host's replication code. Because the parasite had fewer instructions to execute and occupied less CPU time, it had an advantage over complete creatures and proliferated quickly. But the population of parasites had an upper limit. If too successful, the parasites would decimate their hosts, on whom they depended for reproduction. The parasites would suffer periodic catastrophes as they drove out their hosts.

Meanwhile, any host mutations that made it more difficult for parasites to usurp the replication abilities were quickly rewarded. One mutation in particular proved cunningly effective in "immunizing" potential hosts — extra instructions that, in effect, caused the organism to "hide" from the attacking parasite. Instead of the normal procedure of

periodically posting its location in the computer memory after reproducing, an immunized host would forego this step. Parasites depended on seeing this information in the CPU registers, and, when they failed to find it, they would forget their own size and location. Unable to find their host, they could not reproduce again, and the host would be liberated. However, to compensate for its failure to note its size and location in memory, the host had to undergo a self-examination process after every step in order to restore its own "self-concept." That particular function had a high energy cost — it increased the organism size and required more CPU time — but the gain in fitness more than compensated. So strains of immunized hosts emerged and virtually wiped out the forty-five-instruction parasites.

This by no means meant the end of parasitism. Although those first invaders were gone, their progeny had mutated into organisms adapted to this new twist in the environment. This new species of parasite had the ability to examine itself, so it could "remember" the information that the host caused it to forget. Once the parasite recalled that information it could feast on the host's replication code with impunity. Adding this function increased the length of the parasite and cost it vital CPU time, but, again, the trade-off was beneficial.

Evolutionary arms races were a familiar turf for ecologists such as Tom Ray. In the natural biosphere, of course, they extended over evolutionary time, measured in thousands of years. But even a true believer such as Ray was astonished at how easily a digital terrain could generate this same competition. Tierra had developed identical phenomena within ten minutes! Just as remarkable was that his system had produced this situation, previously wedded to biology's domain, without any manipulation whatsoever.

inched past the original. Eventually, some bars directly below those two began pulsing, indicating that even smaller mutations had successfully found ways to self-replicate. Ray was thrilled; Tierra was displaying the effects of evolution, as variations on the original were discovering more successful strategies for coping in the environment. The smaller organisms were more successful because their slightly shorter length

"In my wildest dreams that was what I wanted," he said. "I didn't write the ancestor with the idea that it was going to produce all this."

Most satisfying to Ray was an effect clearly triggered by Tierra's open nature: on its own, the system had shifted the criteria for what constituted a fit organism. When the soup filled with organisms, the evolutionary landscape itself changed; the digital creatures were forced to seek novel responses to their altered circumstances. They did this by rewarding what previously would have been hopelessly ineffectual mutations. The door was opened to unprogrammed diversity.

"At the outset, selection favors efficiency towards the size bias we set up," explains Ray. "But as the system runs, mutants do odd things, and one of the odd things they do is discover other creatures, then exploit them. The parasites don't contain all the information they need to replicate, but they find that information in their environment, which now consists of other creatures. And it even turns out they alter each other's information, and in that way divert someone else's energy resources into the replication of their own genome. That's where the evolution gets interesting, because they're all still trying to make their code more efficient, but the bulk of evolution is coming from exploiting each other. The organisms have added a whole new realm to the fitness landscape, a new adaptation for passing on their genes, a specific mechanism not present in the ancestor. In this case, parasitism, or immunity to parasitism."



THE EMERGENCE OF DIVERSITY in Tierra's maiden voyage was no anomaly. Although each subsequent run differed in some respect, the major effects kept repeating. Within a few million instructions parasites would

emerge, and an evolutionary arms race would ensue.

Ray conducted a variety of experiments with Tierra. As an alternative to inoculating the system with a single ancestor, he injected the soup with creatures evolved from previous runs. His gene bank soon grew to over twenty-nine thousand different genotypes of self-replicating organisms, of over three hundred size classes. Typically, he would isolate a certain host and a certain parasite and see the effects. Then he would sort and analyze the results with the aid of an accompanying program called Beagle, honoring the ship on which Darwin voyaged to the Galapagos.

"This sort of thing should be very interesting to population geneticists," says Ray. "Never before has anybody been able to look at genetic change in a population right down to frequency of every genotype in every species of a community. I'm making a record of every birth and death. I can go back and figure out why one variation beat out another, look at its code and determine what gave it the advantage."

Using this method, Ray duplicated various biological phenomena observed in the field by ecologists. In one experiment, Ray gauged the effect of introducing a parasite organism into a previously pristine ecology; then, trying the opposite, he removed parasites from the soup. "Just as in natural ecological communities, the presence of a predator doubles the diversity," he says. "The predator [parasite] tends to suppress the dominant host competitor, and prevents it from competitively excluding the weaker competitors. So Tierra reflects real ecological communities in a very nice way."

Ray's other experiments indicated that genetic mutation itself is not necessarily the driving force behind evolution. In one experiment, he adjusted the parameters

"Just as in natural ecological communities, the presence of a predator doubles the diversity."



of the system by switching off the background noise and eliminating mutations from replication. He inoculated the soup with hosts and parasites, and diversity emerged as surely as before. He attributed this to the effect caused by the "sloppy replication" that occurred when parasites tampered with the host genomes. The host codes were sometimes broken, causing an effect much like crossover. Along with Hillis's findings and related work by Kauffman and Koza, this result was a further indicator that the evolution of organic complexity, and possibly sexual reproduction, might owe much to the emergence of parasites.

Like Hillis and Koza, Ray believed that digital evolution had the potential to become the engine of practical computer pro-

gramming in the next century. Tierran organisms, like Hillis's Ramps and Koza's LISP creatures, were capable of brilliant feats of code crunching. As millions of instructions were executed, Tierran organisms optimized their size, managing to compact very complicated algorithms into instruction sets much smaller than those with which they began. Ray saw organisms clock a 5.75-fold increase in efficiency. The organisms performed this wizardry by using the extremely nonintuitive techniques that come naturally to artificial organisms.

One example illustrated how organisms discover programming tricks. Ray's creatures commonly had pieces of code, or templates, to mark where they began and where they ended. (These acted as a sort of membrane to isolate the creature from the environment.) But one species of creature hit on an idea that enabled it to evolve without using a template to mark its end. "These creatures," wrote Ray, "located the address of the template marking their beginning, and then the address of a template in the middle of their genome. These two addresses were then subtracted to calculate half of their size, and this value was multiplied by two . . . to calculate their full size."

Ray's organisms were capable of more complicated tricks. After one run of fifteen billion instructions, he examined a certain creature he named "72etq." (Ray named his organisms by the number of instructions in their genotype, followed by three letters, representing the order in which the creature appeared in his experiments. Thus the ancestor was called 80aaa, and 72etq represented the 3,315th different version of a creature seventy-two instructions long.) This particular organism executed a series of algorithms that performed a sophisticated optimization technique called "unrolling the loop." It allowed the creature to operate

with a genome half its actual size (thirty-six instructions) by a complicated but highly compact series of instruction swaps and self-examinations. According to Ray, "The optimization technique is a very clever one invented by humans, yet it is implemented in a mixed-up but functional style that no human would use (unless very intoxicated)." Ray managed to examine carefully only a small percentage of the genomes of his more evolved creatures; it is logical to assume that others had devised equally impressive optimization schemes that may or may not have been worked out by humans. One could speculate that environments like Tierra might find utility as virtual laboratories for generating the algorithms that would drive the devilishly complex computer programs run on the supercomputers in the next century.

Still, the most spectacular news from Tierra was its analogue to biology, particularly in the diversity that emerged when Ray allowed it to run for mammoth sessions. A series of eras unfolded. These appeared suddenly, after long stretches of stable behavior. (This was further confirmation of Hillis's discovery that punctuated equilibrium emerges spontaneously in computational evolution.) In each of these, genetic explosions erupted noiselessly, marked on the screen only by a profusion of different levels on the dynamic bar chart. (Later, one of Ray's students improved the display so that different organisms would be represented by colored rods.) Yet to an observer supplied with the knowledge that the tiny world had undergone a sort of evolutionary apocalypse, these shifts in light seemed accompanied by Wagnerian fanfares and blinding flashes of lightning. It was history on the grandest possible scale.

A typical experiment of this sort could begin with an inoculation of a single ancestor. Soon came

the almost inevitable appearance of parasites and host adaptations to resist the parasites. For millions of instructions, Tierra maintained a pattern wherein two sets of organisms — descendants of organisms of around eighty instructions and parasites with around forty-five instructions — maintained their presence in the soup. Suddenly, a new sort of organism arrived and began to dominate. On examining the code, Ray discovered that these new mutants were *hyper-parasites*: although derived from the genomes of host organisms, they had developed an ability to divert the metabolism of the parasites in order to bolster their own replication function.

The hyper-parasites were remarkable creatures. They were the same length as the eighty-instruction ancestor, but subsequent evolutionary pressure had changed almost one-fourth of the genome and replaced the ancestor's instructions with others. Those changes greatly enhanced their fitness by allowing them not only to replicate but also to fatally attack their small competitors. This stunt was dispatched in a manner that would win accolades and envy from any skilled hacker: hyper-parasites managed to examine themselves constantly to see whether parasites were present. If a parasite was detected, the hyper-parasite executed a Pac-Man-style maneuver. Transmogrifying from victim to victimizer, it diverted the parasite's CPU time to itself. The assault was so devastating that its continued repetition drove the parasites to extinction.

From that point on, cleansed of simple parasites, Tierra went into another long period of relative stability. No longer burdened with competing parasites, the host organisms, almost all of which were now hyper-parasites, searched evolutionary space in an attempt to maintain the genetic integrity necessary to replicate, while consuming less energy. The

method by which the hyper-parasites accomplished this recalled experiments by Robert Axelrod and others studying the evolution of cooperation. Groups of hyper-parasites worked symbiotically, sharing the code for replication. This new variation could not reproduce on its own but relied on similar organisms to provide the missing piece of the reproductive gene. Like pairs of cooperating participants in the iterated Prisoner's Dilemma, each organism realized a benefit from the symbiosis.

This utopian scenario continued for millions of instructions. It was, however, doomed. Formalized cooperation had become yet another aspect of the environment to be exploited by an opportunistic mutation. In this case, the interloper was an organism that shrewdly placed itself between two cooperating hyper-parasites and intercepted the genetic information for replication as it passed from one to the other. It was as though a quarterback and a half-back, smug in the knowledge that no defensemen were nearby, had been practicing handoffs, and suddenly, inexplicably, a defensive back emerged from nowhere and spirited away the precious football. By commandeering the replication code in one well-positioned grab, this hyper-hyper-parasite, or "cheater," was able to reproduce and thrive with a body length of only twenty-seven instructions.

"When the hyper-parasites drove the parasites to extinction at around 550 million instructions, I thought that I was never going to see them again because the defense seemed ironclad," says Ray. "But the evolution of sociality made them vulnerable again, and gave the parasites a way back into the system."

As each run of Tierra unfolded, Ray and others attuned to the behavioral mosaic of ecology could recognize biological phenomena

as they emerged. But, because Tierra was life of a different sort, a truly synthetic form of life, it may have been displaying behavior that was lifelike but characteristic mainly of an alternative form of life. Tom Ray admitted a problem in identifying these possible effects: "What we see is what we know," he wrote. "It is likely to take longer before we appreciate the unique properties of these new life forms."



TIERRA'S INSTANT ABILITY to yield the drama, and apparently the dynamics, of an evolutionary biosphere changed Ray's life. The same ecologists at Delaware who once refused him tenure now came to his office and spent hours staring at the bars on his computer screen. Ray won tenure. Others at Delaware, particularly a group of computer scientists, became committed enthusiasts, and soon Ray was at the forefront of a Newark-based a-life study group.

Still, Ray suffered the reluctance of those who had difficulty conceiving of lifelike phenomena arising from the bowels of a computer. When one official at the Air Force Office for Scientific Research (AFOSR) reviewed Ray's work with Tierra, he passed it around and found not only resistance to supporting the idea but also an edge of ridicule, a suspicion that Ray had perhaps overly relied on science fiction for his vision. Some at the AFOSR wondered whether some of the modest funding devoted to other experiments under the rubric of artificial life should not be reconsidered: Doyne Farmer had to reassure the funders that serious science was indeed the agenda of this new field.

As Ray continued his work, however, and began circulating his results among computer scientists and biologists, Tierra gained a level of respect unprecedented among a-life experiments. IBM, excited about the possibility of

This utopian scenario continued for millions of instructions. It was, however, doomed. Formalized cooperation had become yet another aspect of the environment to be exploited by an opportunistic mutation.

transferring the methodology of Ray's organisms to the principles of programming massively parallel computers, awarded him a \$15,000 prize in their super-computing competition. Ray's work won attention from science journals and the lay press. The Santa Fe Institute invited him to spend six months as a visiting fellow. Perhaps most impressive of all the reactions came from the ranks of biologists, most of whom were extremely wary about the possibilities of producing lifelike phenomena on computers. When Ray presented his results to a gathering of evolutionary biologists, he won the respect of key evolutionary biologists like John Maynard Smith. Ecologist Stephen P. Hubbell of Princeton,



Jim Woodring

originally a skeptic, attended a seminar on the work and described it as "spectacular." Another noted biologist, Graham Bell of McGill University, described Ray's system as "the first logical demonstration of the validity of the Darwinian theory of evolution," and wrote a letter touting Ray's system.

This work has three important uses. First, it is a superb educational tool. Many people doubt that the theory of evolution is logically possible. . . . Now, one can simply point to the output of Ray's programs; they are the ultimate demonstration of the logical coherence of evolution by selection. Secondly, it seems likely to provide a superior method for testing theoretical ideas in evolution,

by providing more realistic general algorithms than have ever before been available. Thirdly, it may also represent a general advance in computation, since it makes it possible to evolve efficient algorithms for any purpose. . . . I am writing to assure you that it . . . ranks among the most interesting developments in evolutionary theory in the last ten years.

Ray would cheerfully admit the limitations of his system — he noted that several magnitudes of increased computer power would be required to support a system to evolve more complex creatures, one that could support life forms with the equivalents of both DNA and RNA, for instance, or multicellular organisms. But in a sense Tierra had already accomplished

one of Ray's prime goals — the beginnings of a shift in perception caused by a successful implementation of open-ended artificial evolution. An indication of this came in the August 27, 1991, edition of the *New York Times*, declaring that, on the heels of Tierran evolution, "A new round of debate has developed among scientists as to where the dividing line between life and non-life may lie." A debate long anticipated by the proponents of artificial life.

Tom Ray had an additional viewpoint on the ability of Tierra to evolve the workings of biology from a digital soup: "The conclusion I draw from it," he says, "is that virtual life is out there, waiting for us to create environments for it to evolve into." ☺

PROVING WHAT?

BY ANTLER

How in autumn, even before the leaves fall,
When they're all at their height of color,
Next year's leaves are already there, tiny,
on either side of the stem of each leaf
where it meets its branch,

Already there, waiting,
Before the leaf that is still there
is dead and falls,
Tiny folded leafbudsheath
Resembling two hands in prayer
Palm to palm with fingers extended.

Proving what?
Life after death exists
even before you're dead.

Or how when a redwood tree is cut down or blown over
It doesn't die: because the roots
Curl up out of the earth and become
new trees,

Each of which can grow to be
Just as tall just as old
as the tree which was there before.

It'd be as if you were cut off at the ankles
And your top taken away to make *The Milwaukee Journal*,
And your toes curled into the ground and came up
as ten new "you"s — looking exactly like you
and being exactly you.

And so a redwood you see now that's 2000 years old
may've come from the root of a redwood that was 2000 years old
that may've come from the root of a redwood that was 2000 years old
so far back that it's literally one million years old!

And *that's* why they're called *Sequoia sempervirens*,
ever-living.

Proving . . . what?
Even before you're dead
life after death exists. ♡

Antler's poetry last appeared in WER #66 (Spring 1990). He lives in Milwaukee, but most of his recent poetry is about what happens outside cities. This poem is from his forthcoming book, *Ever-Expanding Wilderness*.
—Richard Nilsen



A BEDROCK

BY TOM NESS

FOR MILLIONS OF YEARS plate tectonics have been pushing Mount Tamalpais higher. The mountain (in Marin County, on the California coast) that local Native Americans called "Sleeping Lady" now stands at 2,571 feet. For the same length of time erosion has been wearing her down. When the deluge rains came in the winter of '82, many of the steepest streambeds were scoured down to clean bedrock of graywacke sandstone. When the flashfloods subsided, all of the redwoods in those streambeds came to rest in massive jumbled dams of boulders, logs, and gravel up to twenty feet high.

In the spring, thousands of redwood shoots began to burst out of fissures in the bedrock, re-sprouting from roots that had been inaccessible to the fury of the flood. I began to wonder if *anything* could kill these irrepressible trees. They were obviously undaunted by floods, had legendary resistance to fire, and took wind

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• Arabian Mammals A Natural History
Jonathan Kingdon

The Arabian peninsula is home to a diverse mammalian fauna, with many distinct races and forms found nowhere else. The harshness of the desert necessitates some unusual and unique adaptations, and many of the species are endangered.

Written and illustrated by the author of

EXISTENCE

blow-downs as a temporary setback. I couldn't think of any insect, viral, or fungal pathologies leading to their death. I was stunned by the implications of this apparent immortality. I had every reason to believe that the trees I was watching push out from solid rock were as old as the species' presence in the region, or as old as the watershed they were helping to carve, whichever came first. There are no biological reasons why the same living individuals couldn't ride the mountain up during its lifting phase and follow it back down as erosion takes its course over geologic time.

The oldest trees (based on ring counts) are the bristlecone pines in California's White Mountains, at around 4,000 years. The oldest recognized individual plants, extrapolated from known growth rates of outward-moving rings of continuously living roots, are creosote bushes in the California desert. Some are estimated to be an astonishing 10,000



PHOTOS BY RICHARD NILSEN

years old. But the existence of unlimited lifespan potential in other plants has not been fully explored, and there may be living plants for whom the whole of human history has been a blur of sunny days and starry nights. The Biblical injunction that the meek shall inherit the earth may not refer to people who turn the other cheek, but to a deeper evolutionary principle which humans violate at their peril. ☹

Tom Ness wrote "Reflections of an Outlaw Volunteer," about his experiences fighting last year's Oakland, California, fire, in our Spring 1992 issue. He now lives in Grants Pass, Oregon. —RN

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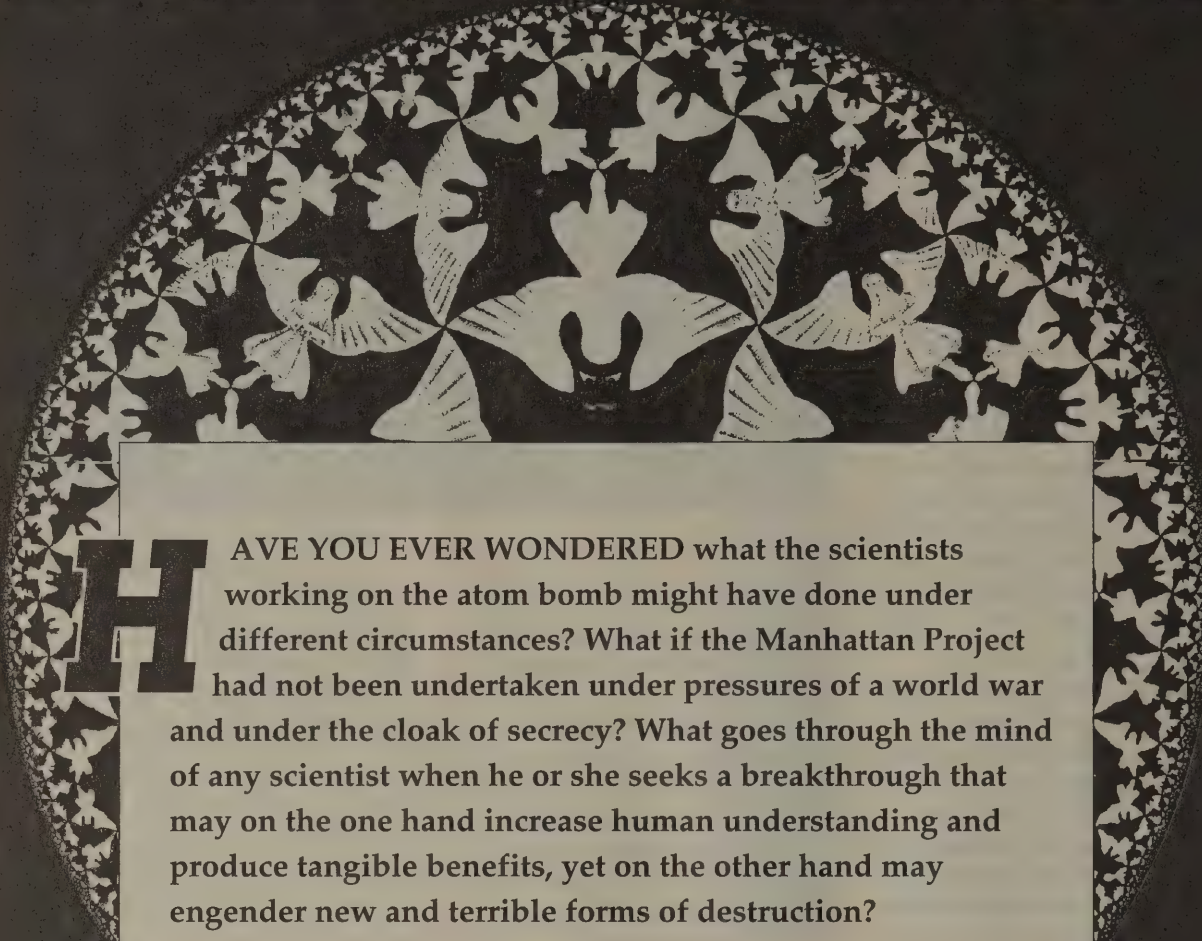
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A-Life Nightmare



HAVE YOU EVER WONDERED what the scientists working on the atom bomb might have done under different circumstances? What if the Manhattan Project had not been undertaken under pressures of a world war and under the cloak of secrecy? What goes through the mind of any scientist when he or she seeks a breakthrough that may on the one hand increase human understanding and produce tangible benefits, yet on the other hand may engender new and terrible forms of destruction?

These questions came to mind when I was conducting the interviews that were the backbone of my book, *Artificial Life* (Pantheon, 1992). Not that this new scientific domain is primarily directed toward producing weapons. Artificial life, or a-life, is the study and creation of human-made systems that behave like living systems. The artificial organisms midwived by a-life researchers can exist in pots of chemicals or within the silicon maelstrom of a computer or robot. Like real organisms, they display independent behavior, often as a result of evolution, which can be produced by a digital version of natural selection. There are two points to doing artificial life. First, we

will gain a better understanding of nature, of life itself. Second, we can create a powerful new technology based on nature's most ingenious product — living organisms. The eventual benefits of artificial life are limited only by imagination: self-reproducing factories, microscopic disease-killing machines, a menagerie of lifeforms performing useful functions.

But as in the case of nuclear technology, the potential dangers of a-life are horrifyingly vivid, particularly if humankind uses them for warfare. (Since much of the research is government-funded, this is not a remote fear). To quote physicist Doyne Farmer (in an essay

Sometimes, the outtakes are as important as anything else in a book. But certain passages hit the cutting-room floor because something has to be trimmed, or because they lead away from the main thrust of the argument. When he read WER #73, the "questioning technology" issue, Steven Levy called to tell me he had something he knew WER readers would find interesting. In the following pages, you have a chance to read what the a-life researchers in Steven Levy's book (p. 22) had to say when they faced the ethical and moral implications of their work. These passages didn't end up in the book, but the author thought they ought to get wider circulation. If you've read "Deep Evolution" (p. 4) and the excerpt from Artificial Life (p. 22), you're ready for the truly scary stuff. —Howard Rheingold

he co-wrote with Alletta D'A. Belin), "Once self-reproducing war machines are in place, even if we should change our mind and establish a consensus, dis-mantling them may become impossible — they may be literally out of our control. An escalated technological war involving the construction of artificial armies would certainly end by destroying the participants themselves, and would give rise to a generation of lifeforms that might be even more hostile and destructive than their human ancestors."

Fortunately, the scientists working in this upstart pursuit recognize the dangers, and have consciously determined that this awareness must be intimately woven into the practice of artificial life. Led by Chris Langton, the Los Alamos computer scientist who was instrumental in organizing the field, they insist that their work, and the issues it raises, submit itself to public scrutiny and discussion.

Less clear is whether or not this process will mitigate the danger. Has there ever been a technology with a power for destruction that has not been deployed? Another problem: artificial lifeforms could present a threat to humanity even if they were not used in a military capacity. Artificial life is a science of emergence — its

results are not specifically programmed by its creators. In order to evolve with the full power of nature, our artificial offspring would by definition be guided by their own needs. Allowing them to fulfill their potential might cause grave problems for us. At the least, we might have to consider some sort of civil rights for artificial organisms which satisfy any reasonable definition of "living." At the worst, they may ultimately supplant us. Some a-life researchers do not see this as a problem; rather, they believe that it is the role of human beings to pass the evolutionary baton to these artificial creatures. While species routinely come and go, this might represent the first conscious passage of that sort; thus the process is ripe for debate.

Though these issues will not really become vital until years or decades hence, when the experiments now beginning in artificial life see fruition in complex artificial creatures, inevitably my sources and I would discuss them. Though often these conversations seemed transplanted from science-fiction novels, I came to realize that there was something quite unique here. Almost without exception, I found those working in the field to be responsible, concerned, and

thoughtful — true friends of the earth. They believed that ultimately the contribution of artificial life would be overwhelmingly positive. Yet none could deny that their work also held the potential to change humanity irrevocably. Like Mary Shelley's fictional Victor Frankenstein, they were flirting with a conceivably catastrophic hubris. Looking over the transcripts of my interviews, I realized that some of these discussions were too rich to file away. The white-hot center of artificial-life studies is New Mexico, specifically the T-13 Complex Studies Group at Los Alamos National Laboratory and the Santa Fe Institute. In September 1989, I conducted this joint lunchtime interview at a restaurant in Los Alamos with Doyne Farmer, head of the group (he has since left the lab to start the Prediction Company), Chris Langton, the resident artificial-life maven, and Steen Rasmussen, a physicist from Denmark.

FARMER: I think we have to be kind of careful. You know, frankly, I had some hesitation about writing this article ["Artificial Life: The Coming Evolution," printed in *Artificial Life II*, the proceedings of the second a-life conference] or seeing you write this book because in a way I'm almost nervous about having too

much public attention focused on this. I think it's quite likely we're going to have the Jeremy Rifkins of the world breathing down our necks; in a way, rightly so. I think some amount of attention needs to get focused on this issue, because we do need to address it, but I know it's going to be a pain in the ass to have a certain class of people irrationally ranting and raving about it.

LANGTON: That's why it's important that we do discuss these kinds of issues. It is correct that people should be asking these questions, and we should be doing it rather than waiting for somebody outside to jump in.

FARMER: Yeah. Right now it's kind of nice in a way that artificial life is underground, because it means we can keep a low profile and just do what we want. But as responsible scientists I really do think that this is the thing that's going to have the biggest impact on the world in 100 years, and as responsible scientists we should try to get it out there in front. And we should do that before it happens — before the bomb is here.

LEVY: Do you think it would have made a difference if scientists who devised the atomic bombs spurred public discussions beforehand?

FARMER: It's hard to say.

LANGTON: It's a good question, though.

FARMER: Oppenheimer actually proposed something. His proposal was that there be a world nuclear energy commission that would basically regulate nuclear energy worldwide. The secrets would be shared among the Western powers. Basically between us and the Soviets. And there would be a regulatory commission that would control all this stuff. He was overruled. Okay, it's probably unrealistic

Maybe things could go bad, but to a large degree it's our responsibility to make sure that we don't create a monster.

—Doyle Farmer

Farmer

to think that they would have been able to pull off what Oppenheimer was advocating, but if they could have done it I think it would clearly have been a hell of a lot better than what happened. And I think one of the differences that I think artificial life is going to . . . (pauses) Well, it's hard to say.

[Artificial life] may come on us gradually, but I think on the other hand I think we're seeing the precursors leading up to it right now. It may be a little bit like computer viruses; you go along, ha-ha-ha, computer viruses. And then one day you go in to work and don't get any work done for two days because

the virus has locked everything up. Now, that's not such a big deal, certainly at this point not at all like nuclear weapons. But on the other hand it may be that once artificial life starts happening it happens a lot faster than [we would have guessed]. Exponentials are always deceptive in that regard. And I do think we're on some kind of exponential growth curve. One day it's just going to sweep over us and I think it's going to be a lot better if we're prepared. If we've thought about the issues, if we know how we're going to address them, if they've been aired properly before that happens.

LEVY: But I see a similarity to the



Kevin Kelly

Oppenheimer thing right now. At the end of your publications, Doyne, you always have a statement to the effect that you hope the ideas contained are not used in military applications or killing or things like that —

FARMER: It's probably a futile hope. You really should read *Fiasco*, by Stanislaw Lem. [It occurs in the far future.] We finally get to the stars and we encounter life on other planets. It's hard to sort out because a lot of it is artificial life by then; but there's this belt of stuff, they think it's a ring around the planet. But it turns out to be basically a big SDI system [a remnant of a dead civilization]; and furthermore it's a live SDI system. Because you can't really control something like that from the ground, they made more and more of it autonomous and self-reproducing, and pretty soon it's a creature, a very hostile creature. It's ironic in the blackest way — very black humor, but I think very a propos to the potential problems with this kind of stuff.

LANGTON: By the way, if you're going to be reading books you've

got to read *Frankenstein*. I mean, it's so different from the movie, and it's a very insightful book.

FARMER: The point of the book was, I think, that Dr. Frankenstein himself was the monster. He created this thing and then abandoned it. And he didn't accept the responsibility for the thing he created. [But we working in] artificial life cannot deny the responsibility for the things we create. Maybe things could go bad, but to a large degree it's our responsibility to make sure that we don't create a monster. It would be monstrous of us if we created these things without thinking of [the consequences].

RASMUSSEN: As far as I see it, once we understand these powers of creation in nature the result will be very, very, very much more powerful than the discovery of the bomb, and it will have much wider consequences. I can really imagine that will happen. What I sometimes feel bad about is that I don't think that mankind is grown up enough to take this responsibility. I'm not convinced that the day we are able to initiate

processes which will create life with certain properties [will initiate] a better life — I mean the good life for humans.

LANGTON: I think it goes to an extremely deep metaphysical question of what is the purpose of life, but not just human life. My feeling is that it is out of our control; we are just little cogs in a much bigger evolutionary process. We're little leaves being swept down the stream, and all we can hope to do is perturb ourselves to the right or to the left to influence the overall flavor of this evolutionary direction.

LEVY: Some people are saying that evolving artificial life is almost an inevitable part of our evolution.

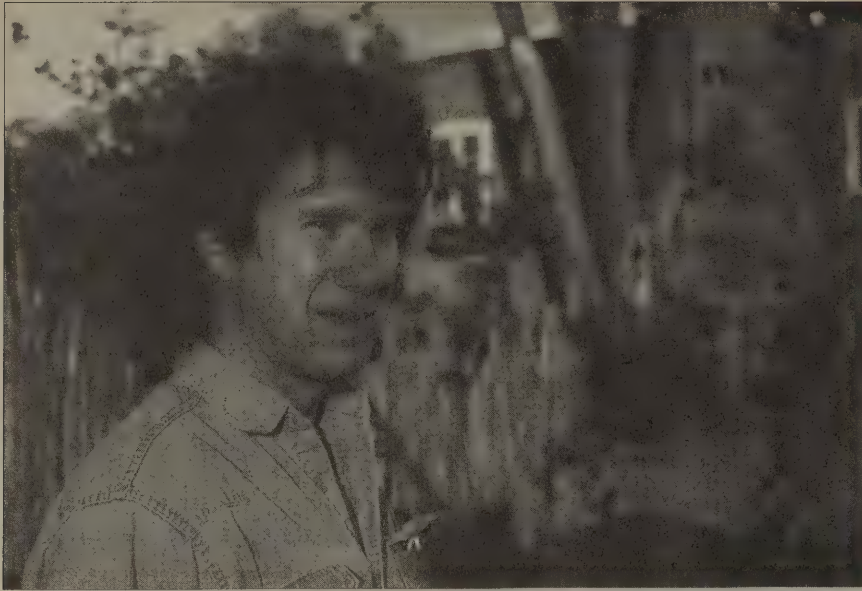
LANGTON: Well, I think so. All life that we know has evolved and passed on and changed. . . . But one of the other things that we learn from evolution is its incredible sensitivity to small details. A little accident happening to this creature fathered this line of things . . . that mutation occurred, led to that creature. The problem with making a science

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—Steen Rasmussen

Rasmussen





**By the way,
if you're going to
be reading books
you've got to read
Frankenstein. I
mean, it's so
different from
the movie.**

—Chris Langton

Langton

of evolution is that it's so dependent on historical accident. That means it's incredibly sensitive to conditions.

FARMER: We see this in chaos theory. If you really are on top of it watching what's going on carefully, a little push in just the right place may make a very big difference.

LEVY: Steen, let me pick up on your last comment. You said before, humanity isn't grown up enough to handle this — yet here you are and you're working to bring this about sooner. Isn't there an inherent contradiction?

RASMUSSEN: Yeah. I feel in some way that I am committing sin by the things I am doing. If you ask me really honestly, "Steen, why are you doing this?" I can't answer you. But alternatively you could say, "Well, what would you like to do instead in order to make a nicer or a better life for your children and grandchildren?" And I don't know.

LEVY: Put aside the idea of making a better life for your children and address the contradiction that you might be making life

worse. You must have a better answer than "I don't know."

RASMUSSEN: Let me try to put it another way. I think that the best way to have influence on what will happen is probably being on the forefront or the cutting edge of this issue. Because I feel that this issue — the understanding of adaptive systems and the understanding of evolution — is what will change the world most in the foreseeable future. If we want to have some influence on how it's going to be used and which direction maybe it will take, then we better be there.

LEVY: But I suspect the reason you have a sense of sin is because you know historically that despite the good intentions of scientists concerning their creations, the applications go beyond their control.

RASMUSSEN: I know that, but on the other hand what else can you do? I would not say this is the only thing [motivating me]. There's curiosity.

LEVY: Right, it's scientific curiosity.

FARMER: There's also another

urge which I think is almost unconscious, and I think it has to do with the notion that culture is another evolutionary process [You ask me,] "Well, how would you feel about your children living in a world where there was a lot of artificial life?" My immediate reaction was my biological children, but in some sense these other things are going to be our children as well. I mean this is why [roboticist Hans] Moravec calls his book *Mind Children*. In some sense there's almost a biological urge to produce offsprings of new ideas. And if these ideas actually can be embodied and come to have a life of their own, then in some sense it's more than just passing ideas around which can be produced. The ideas themselves are going to come to life in some sense.

Danny Hillis is cofounder and chief scientist of Thinking Machines, Inc., which makes the parallel-processing supercomputer he invented, the Connection Machine. Hillis is fascinated by the emergent processes of life itself, and believes that we can use them not only to make comput-

ers intelligent, but to make computers companions — and, perhaps, worthy evolutionary successors to human beings. He has said, “I want to make a machine that will be proud of me.” We spoke about this in May 1990, eating lunch at the rooftop cafeteria of his company.

LEVY: I was talking to someone yesterday who insisted that we should never make anything that’s self-reproducing.

HILLIS: You can’t make anything that’s self-reproducing? Why not?

LEVY: Well, he doesn’t want us to lose our franchise, I guess.

HILLIS: But you see, I think that’s a silly point of view. It doesn’t bother him that grass is self-reproducing, or frogs, so why should it bother him that [artificial life] does? I mean, we don’t have a franchise right now.

LEVY: Well in the last artificial-life conference, you responded to a question in a way that intrigued me. I forget what the question was but you said, “Well, maybe our evolution isn’t so important anymore.”

HILLIS: Right. I guess I’m not overly perturbed by the prospect that there might be something better than us that might replace us. Because as far as I’m concerned we’ve just kind of recently crawled out of the muck. We’ve got a lot of bugs, sort of left over history back from when we were animals. And I see no reason to believe that we’re the end of the chain and I think that better than us is possible.

LEVY: But we’re us.

HILLIS: Don’t you want your son to be better than you? I mean, do you want your son to inherit everything that was good about you and leave behind everything that was bad about you?

LEVY: Well, it depends. I want

my son to be human. I wouldn’t want him to be improved in ways which wouldn’t make him human.

HILLIS: Well, to me what’s important about humans is that they love, create and think. Certainly I wouldn’t want to be replaced by something that didn’t do those things. To me it’s not very important that humans have five fingers. If I had a son with six fingers and somehow that enhanced his ability to love and create, then I would feel very happy about that. So it doesn’t bother me — the notion that by changing some incidental things (and it may be that what our metabolic basis is is incidental), you can preserve what I think is important about humans. So I would call them human.

LEVY: But are these positive traits the things that make humans fit? Does evolution promote those? From an evolutionary standpoint, the fact that we create and all the other upstanding things that you’re talking about might not matter so much as —

HILLIS: I understand, exactly, and that’s why it doesn’t bother me — the notion of changing the rules of evolution and creating another evolution with another set of rules, a set that may be more likely to evolve the things that I think are good and that I admire. We’re a symbiotic relationship between two essentially different kinds of things. We’re the metabolic thing, which is the monkey that walks around, and we’re the intelligent thing, which is a set of ideas and culture. And those two things have coevolved together, because they helped each other. But they’re fundamentally different things. What’s valuable about us, what’s good about humans, is the idea thing. It’s not the animal thing.

LEVY: Right. If some alien be-

ings took a human egg and gestated it somewhere away from any human contact, what you got wouldn’t be what you’d want to call human.

HILLIS: Exactly. So to me, if we can improve the basic machinery of our metabolism [the result can still be “human”]. See, I think it’s a totally bum deal that we only get to live 100 years. I think that’s awful, that’s barely enough chance to sort of get going.

LEVY: How old are you?

HILLIS: Thirty-three. And I want to live for 10,000 years. I’ve really got 10,000 years’ worth of stuff to do and I’m sure by the end of that I’ll have another 10,000 years’ worth of stuff to do. I don’t see any reason why that shouldn’t be possible if I had a better metabolism. Now I have the same nostalgic love of human metabolism that everybody else does, but to me it’s a tradeoff. If I can go into a new body and last for 10,000 years I would do it in an instant, no second thoughts. I actually don’t think I’m going to have that option, but maybe my children will.

LEVY: If cultural evolution combined with genetic legacy winds up to improve humans, wouldn’t that in theory frustrate the ecology of humans?

HILLIS: I understand there may be some of that problem. But there’s two arguments I have against that. One of them is that we’re not limited by resources, because humans as we are now take away too many resources. I mean, if humans were just a quarter of the size they are now, we could fit twice as many people on the earth. It’s just a coincidence that we’re this size, for instance. So there’s nothing fundamental about what constrains the resources. You can change that.

The other thing is there’s nothing

fundamental about what the right thing is. Why do you think 100 years is the right lifespan, or 75 years? Maybe there's an argument that says that we should kill everybody when they're 33.

LEVY: Maybe.

HILLIS: It's not like we selected that number for optimality of idea evolution. You're right — 10,000 might not be right either. My intuition is that 100 is too short. In fact I think that ideas have exploded as lifetimes have gotten longer.

LEVY: What's happened is we've all hooked up to the equivalent of the Connection Machine. Cultural evolution has gone at such a frantic pace that genetic evolution is relatively imperceptible.

HILLIS: Yeah, I think that's right. But I don't think that that's necessarily bad. Certainly the evidence is that as people have gotten to live longer it doesn't seem to have hurt the pace of cultural evolution.

LEVY: Well, they haven't lived longer by such a huge factor.

HILLIS: I agree, but that may happen. I just don't see any reason to believe that we're at the optimum place now. It is quite possible that living for 10,000 years would be harmful. But I wouldn't give up the chance to run that theory.

LEVY: Is this concept sufficiently viable to actually drive you to do this stuff? Or is it more of an abstraction?

HILLIS: It's the same thing that sort of makes people wish that there's intelligent life that we can contact. It would be nice to have friends that had a different set of limitations than we do. I would love to have one of my machines be such a friend. People don't like to talk about it, because they don't like to think about death,



Kevin Kelly

When I say things like "I want to build a machine that can be proud of me," that's not just a joke.

—Danny Hillis

Hillis

but I think at some level we all realize that it really is a short time that we're here, and so [we're attracted to the] notion of having some friends that don't have those limitations, or maybe thinking of them as children.

LEVY: To a lot of people it's very scary, the thought of it. I think the only reason why people let you go on thinking such things is that they think that it can't happen.

HILLIS: Sure. A lot of people get scared of the idea that most people speak Spanish in the US. I think it's the same kind of prejudice. I think that people are threatened by things that are fundamentally change, and the idea that something that's different from them could replace them and be better than them,

that bothers people at a very deep level.

LEVY: But the fact that it's better doesn't seem —

HILLIS: The reason people let me think about this kind of thing is that nobody really believes that it's at all possible. But I think that if you had gone back a couple of hundred years ago and showed somebody twentieth century humans and what they did for a living, and how they live and so on and say do you want to be replaced by this, people would have said, "That's horrible, that's terrible," and they would have done anything possible to prevent it from happening.

LEVY: Well, it depends on how you show it.

HILLIS: People are frightened by

making big changes. If I told you that, let's say, the Japanese culture was going to dominate in the future and that we were all going to be living according to Japanese standards, that would bother most Americans at a very deep fundamental level. And similarly it would bother most Japanese if they said that everyone would be living like Americans, because it's something they hold dear to them. But if it happens over a long enough period of time, shifts like that can happen and don't bother people.

Now, what we're talking about is a bigger shift than this, so people have more resistance. But I think it's for the same kinds of reasons. It's because they don't understand it, they don't identify with it.

LEVY: Right. But you've already taken a mental leap to that understanding. I think that's the a-life leap — when you kind of cut yourself off from any form of vitalism and don't have to peel back what's underneath the skin to say whether a being is living or not. You already believe that an artificial machine can be alive.

HILLIS: You're right. That's a very fundamental assumption that I have. And I think it's an assumption in AI, too. It's not like there is some magic essence, this sort of essence of soul that either you get it poured into you or not. And you're right, that's hard for people to believe, just like it's hard for people to believe that the Earth wasn't at the center of the universe. Because they felt somehow they were cheapened if they were just one more planet out there in the cosmos. And I think in the same sense people feel cheapened if they think that they're just machines. But I think that the reason for that is that they have a very limited, narrow notion of what a machine is.

So, I look around at machines I see today and the notion that I'm one of those I find insulting. I mean I don't want to be an automobile, or a steamer or a computer. I mean those are stupid and boring and don't have any of the qualities that I admire in humans. So the notion that I'm one of those I don't like. But I guess where I differ is I see that none of that is fundamental about a machine. And I look at humans as a counter-example to that. I say humans are a kind of machine that do have the properties that I like. So therefore it doesn't bother me, the notion that machines can have those properties.

So if you think of an automobile as your example of a machine, then you're horrified by the notion of being replaced by one. If you think of a human as being an example of a machine, then it's not such a horrifying notion, it's not such a horrifying notion.

The soul is when you take the simple things that you understand the rules of and it has this emergent behavior that is both a consequence of the rules and also not obviously connected to it, infinitely more complicated with it. That's to me where the soul is. And I think that's a much more interesting, robust place for the soul to be than off in some little corner of science which we just haven't figured out yet.

LEVY: But your soul is really kind of a lasso around the results of that emergence, isn't it?

HILLIS: Yeah. It is. But to me that's a very strong place for it to be.

LEVY: Well, but the nice thing also about that construct is that it is eminently possible to build the soul into something if you have emergence of sufficient power.

HILLIS: Yeah, that's right. It's like planting a flower, you know: if you water it and put the fertil-

izer in and the seed and so on, then in some sense you've built a flower, but it's sort of inherent in the seed and in the whole set-up of nature that you can do that. And if I put in a system inside some future Connection Machine that's the right fertilizer, and I give it the seed of human intelligence by talking to it and interacting with it and telling it what I know, and it grows and flowers into a living being, an intelligent being or something like that, then I created it only in exactly the same sense that I've created the flower. I've made it possible for it to exist, and I've nurtured it, but I didn't make up the rules that made it possible for such a thing to exist. I mean that's the sense in which it's mystic, I mean that's what God did. God made it possible to do that.

LEVY: I mean you seem extremely optimistic and confident in following your theories to that conclusion. Can you tell me anything that makes me think it will happen?

HILLIS: I'm saying I would like this to be true. So it's coming more from an emotional thing. I would like it to be true and I don't see any reason why it's not. Okay? And the reason I would like it to be true is because it helps me resolve a bunch of things that are deeply felt. I believe in science, I believe in scientific worlds and the scientific process of understanding, I believe in the soul and the importance of it and I believe that there is something fundamentally good about humans. I'm sad about death, I'm sad about the short time that we have on earth and I wish there was some way around it. I wish we had these long-lived friends to talk with, and things like that.

So it's an emotional thing that drives me. That doesn't mean it's true, but I don't see any reason

why it's not true. And I listen to the arguments people have why it's not true and I think that they're just arguing on emotional grounds, on other emotional grounds. So it's something that I pursue because I'm interested in it and I would like for it to be true. It's not a detached scientific experiment or something like that.

LEVY: And you believe in it deeply enough to actually start doing it.

HILLIS: Yeah, absolutely. And when I say things like "I want to build a machine that can be proud of me," that's not just a joke. That's something that drives me emotionally, and I would feel good if that happened. I think everybody has their image of sort of where they're looking for — a sort of fundamental compelling idea. For me I think it really is that notion of emergence, that something more worthwhile can emerge out of something less worthwhile. And that for me has been a very productive idea. I think I've had some good impact on the world by pursuing that idea. So that encourages me to keep doing it.

Norman Packard is a physicist at the University of Illinois's Beckman Institute, studying complex systems. He has been thinking about emergent phenomena like artificial life for over a decade. I first met him in 1984 when he was in Stephen Wolfram's group at the Institute for Advanced Study in Princeton — back then he was using cellular automata to model snowflakes. More recently he has been developing "bugs" in a modest artificial ecology. The following, almost frighteningly candid discussion occurred during a break from the second Artificial Life Workshop in February 1990, at a noisy restaurant lounge off the Plaza in Santa Fe.

I don't know if our generation is really going to see this particular ethical problem. Ultimately, I think a Blade Runner kind of scenario is not at all out of the realm of conceivability.

—Norman Packard

Packard

LEVY: There are going to be people who just are resistant, very strongly resistant to the idea of living things inside a computer. And you don't have that prejudice.

PACKARD: Yeah.

LEVY: I think it's reasonable to say that the rational views people take are connected somehow to emotional or even subconscious beliefs. I think certain people who might be capable of extraordinary rationality might not take that step to believe in that, just because they would hold to an idea that you can't have it. . . .

PACKARD: I think you're right that people want there to be something sacred about life. And I think there is something sacred, and I think that there is actually

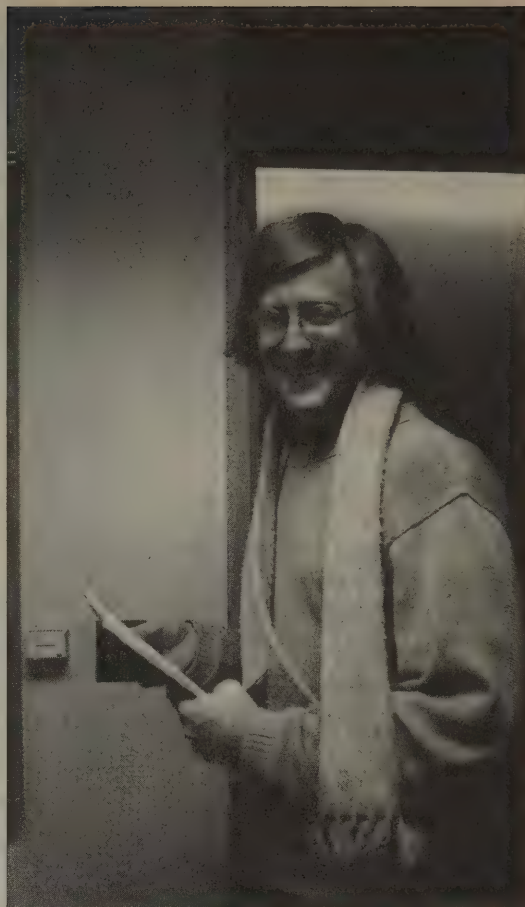
something that's still mysterious, even though I believe you can have a living process in a completely computational realm. I think there's still a question of "what is the nature of the soul," and "in what sense do living things have soul," and I think that that is the real thing that people react against.

LEVY: Where do you stand on that question?

PACKARD: I don't know the answer to that question. I'm not sure yet whether I think that having soul is a property of all life or only a property of some kind of higher life.

LEVY: I'm almost afraid to ask what you mean by soul.

PACKARD: I think the cleanest thing would be to say that all living things have soul, and that



Kevin Kelly

that is in fact the thing that makes them living. But it may be that a more reasonable definition of soul involves some kind of self-awareness.

LEVY: Who's putting the soul in? Is this a process in which we're engaging, is it self-aware or is it —

PACKARD: Maybe it comes out of the void and we have it just for a while, and then it goes back into the void. There's all kinds of theories of what's happening with soul, and none of them are scientific.

LEVY: Right. We're in a nonrational realm now.

PACKARD: I really don't know what the answer is going to be.

LEVY: But Norman, you're working on artificial life, and this is something that presumably will result in the creation of something new, not a creation in the sense that this process creates something, but people create something by their actions, right? This model doesn't occur unless you build it.

PACKARD: The thing is if you can envision something living in an artificial realm, then it's hard not to be able to envision, at least at some point in the future, arbitrarily advanced lifeforms — as advanced as us — therefore they would probably have a soul, too. That logic is kind of hard to get around, and so that tends to make me think that you can have an artificial soul. I wouldn't say an artificial soul, actually, I'd say you can have a soul in an artificial universe.

LEVY: In an artificial organism.

PACKARD: But it would be a real soul.

LEVY: If you created something with a soul, would you perform your research differently?

PACKARD: That depends. That depends.

LEVY: Is it something you've thought about?

PACKARD: Well, I think it depends completely on what the informational channels between you and this thing are. If they are practically nonexistent, if they're all coming to you at 9600 baud to your terminal, then I think it would be difficult to develop a strong empathetic interaction with it.

LEVY: Do you need that empathetic reaction? Is that the criterion?

PACKARD: Yeah, I think that's the criterion for recognizing it emotionally as a soul. You could maybe recognize it rationally as a soul in other bases but recognizing it emotionally as a soul requires you to have a certain empathetic interaction.

LEVY: What's the Turing test for a soul?

PACKARD: In my opinion it will be fairly obvious when it happens. There won't be a big problem.

LEVY: Well, in the model you're working on now, you say you hope to get something — that your "bugs" will convince intransigent skeptics that you can create something living by computational methods. Would there be a soul in that?

PACKARD: Probably so.

LEVY: Would that change at all the way you regard your model, if it's successful?

PACKARD: A little bit, but really I do feel that all living things have, more or less, souls.

LEVY: But you'd step on a bug.

PACKARD: Yeah. Ants have sufficiently small amounts of soul that I don't really get crushed when I happen to step on one, just like I don't feel crushed when I have to turn my computer off, or log off for

the night or something.

LEVY: Yeah, but you're not logging off on anything with souls in them yet.

PACKARD: Well, when does a soul start? Does an amoeba have a soul? If you start to say that an amoeba has a soul then blue-green algae would —

LEVY: Well, I don't know. I'd feel really bad if I killed somebody, and I think the equivalent of a soul is the reason why. But I wouldn't feel bad at all if I were responsible for the death of a million amoebas.

PACKARD: It doesn't really give you a hard time to sleep at night or anything?

LEVY: No, no.

PACKARD: See, I think that the crucial point there is that you just don't have a strong empathetic interaction. You see, I think that the perception of soul is different for different people. Some people are really sensitive and they don't like at all to see ants trodden upon.

LEVY: Can you conceive a time when things you're working on give you ethical problems in terms of working with them and manipulating them?

PACKARD: Yeah, I can conceive of the time. It's kind of an interesting thing to think about but I'm not real worried about it right now.

LEVY: Well, we're kind of far away, aren't we?

PACKARD: I would say so. I don't know if our generation is really going to see this particular ethical problem. Ultimately, I think a *Blade Runner* kind of scenario is not at all out of the realm of conceivability at all. I don't know if people are going to be driven to make realistic androids, or it may be just too much of a technical pain in

All-out atomic war and nuclear winter and all that kind of junk in the overall evolutionary record, with the timescale of billions of years, is a teeny tiny little blip. The biosphere would kind of get jostled around a little bit, maybe a few of the higher life forms, like us, for instance, might just get totally exterminated for a while, but what the hell, it would keep on going.

—Norman Packard

the ass, but I think it's quite possible that you'll develop a relationship with the thing in your wall as a voice coming out of it, or maybe a pattern on the screen or something like that, I think you'll develop a relationship with it, or people will develop relationships with these things that will feel to them very much like real emotional, personal relationships. And then for anybody who does that there will be an ethical problem if termination of the program is made to come about.

I guess the real problem is if you have these things that can self-reproduce then you'll have to deal with the problem whether they have their own rights as entities.

LEVY: They can have their own agendas, certainly.

PACKARD: That could prove to be a real mess.

LEVY: Well, I've heard it said here and elsewhere that this is potentially the next evolutionary step, that we're creating our successors.

PACKARD: Yeah.

LEVY: Which is a pretty heavy thing, right?

PACKARD: It's sort of like a midlife crisis. It has to happen sometime.

LEVY: Well, we have to die, that

has to happen sometime. But you don't have to create the next species. It's never been done on this planet before.

PACKARD: Come on. Things have been replaced by other things for billions of years.

LEVY: Yeah, but not by things they've created.

PACKARD: Not by things they've created, no.

LEVY: If you believe that's possible, aren't you worried about whether it's a good idea to do it?

PACKARD: No. I believe very strongly in a fairly fatalistic way of the inevitability of the evolutionary process.

LEVY: The fact of evolution is inevitable, but where it goes is not.

PACKARD: My point is really that all-out atomic war and nuclear winter and all that kind of junk in the overall evolutionary record, with the timescale of billions of years, is a teeny tiny little blip. The biosphere would kind of get jostled around a little bit, maybe a few of the higher life forms, like us, for instance, might just get totally exterminated for a while, but what the hell, it would keep on going.

LEVY: Well, I mean, there's nothing about the possibility of creating an evolutionary successor, in a much shorter timeframe than

billions and billions of years than it would come otherwise, that at all bothers you?

PACKARD: No. The only thing that worries me is that that somehow we would be so inept as to introduce an element of cruelty into our successors. I don't know how cruelty would be defined in that context.

LEVY: Well, the military is interested in this, and Defense is actually spending money on it, isn't it?

PACKARD: But you see the biosphere has a very nice, delicate but robust, balance of predators and preys. There's stuff that kind of from one point of view seems kind of cruel but on the other hand is just part of a whole game, and you can't get too worked up about it.

LEVY: Well, you can and you can't. I mean you wouldn't kill another person, would you?

PACKARD: Not right off the bat.

LEVY: If your beliefs about artificial life prove out, there are dangers potentially as big as atomic energy.

PACKARD: True. But I have a fairly strong feeling that the process of evolution carries with it an intrinsic fairness to all the entities that have participated. And as long as what's happening is an integral part of the evolutionary process — what's already going on — I think that that fairness will be part of the process. And when I say that the only thing I'm afraid of is this ineptness, that we might introduce an element of cruelty, what I mean by that is that we might not take this next step in a truly evolutionary way.

LEVY: How could we not?

PACKARD: How about this? How about if we developed an entity that was a self-reproducing entity and all of a sudden it

decided it really liked nitrogen, and so it self-reproduced like crazy and it was like — all it needed was ocean water and sand? And it reproduced like crazy and eventually used up all the nitrogen in the atmosphere and the entire biosphere collapsed, the entire biosphere. This is not just a little blip in evolution, this is . . . crunch!

LEVY: In that case, that's where evolution took us. It made us, quote, smart enough to the point where we could make a mistake that big.

PACKARD: That's right, and that would be completely disruptive of the natural, internal, ethical evolution. That would be the most extreme version.

LEVY: I hear a contradiction. On one hand you're saying, "I trust evolution"; on the other hand you're saying, "I'm worried evolution maybe made a mistake by giving us this power to make a mistake this big."

PACKARD: I'm not sure that even with our ineptness that we could screw things up so much. See, when you're talking about evolution, it's real hard to get worked up about it personally because we're talking about billions of years.

LEVY: Yeah, but we're playing around in a different timeframe now, right?

PACKARD: First of all: if we are starting to create our successors, certainly it's going to take more than a generation to happen. You and I are not going to have to worry about the extermination of the human race due to superrobots. And in fact I think that human beings in general will not be the root of the new race. And eventually it may be that human beings die out because — I don't know why, because they get —

LEVY: Well, we're replaced by our creations, who fill up our evolutionary niche.

PACKARD: If we're designing them we can design them to fill up some other goddamn niche. Evolution once set in motion doesn't remain under our control.

I have a very hard time envision-

ing any replacement of a species happening over the timescale of a generation. When the dinosaurs died out it wasn't like one year they were there and the next year hey, they all died off.

LEVY: Oh yeah? What about a meteor?

PACKARD: A few dinosaurs died off in a meteor. That's true.

Artificial Life II

"This is really interesting," was my first thought, as soon as I understood the meaning of "a-life."

"This could be very scary," was my second thought.

Half a dozen people, some of whom I knew, were writing books about it, but I really didn't understand the scope of what those computational biologists were doing with Darwinian software and supercomputers down in New Mexico until I saw this video of the Second Artificial Life Conference. There's something about the way this stuff looks that hits you in the nucleus of every cell in your body. I began to get scared while I was laughing at a short bit in which "Doctor Schitzenheimer" explained how evolving software entities were converging on the machines that snipped the genes for the wetware factories, and when the computational life forms finally met the computers that control the bio-engineering industry, the outcome would be out of human hands.

There's another important factor at work: It's one thing to read about pattern-games on computer screens, and another thing to watch how these simple things begin interacting, and to see how higher levels of order seem to emerge from nowhere, right before your eyes. Chris Langton's "vants" (virtual ants) are patterns of pixels that circulate, according to simple rules, across the surface of a screen. Then you watch intelligent-seeming patterns of behavior emerge as the vant population increases, while their inventor describes the implications in voice-over. Something to look at, something to think about, and they relate to each other.

"Panspermia" is definitely the razzle-dazzle piece, at once inspiring and dis-

turbing. The name comes from the theory that life is propagated throughout the universe by some kind of spore that can escape gravity, survive deep space, and land, as spores sometimes do, on fertile ground. If the essence of life is a pattern that works just as well in silicon as meat, then the idea of building such a spore is irresistible. This computer-generated video was created at Thinking Machines corporation, using their legendary Connection Machine multiprocessor supercomputer. The key to unlocking the full impact of this bit of imagery is the knowledge that the images are created by the very processes that the story they tell seeks to describe. The graphics were created from "seeds" that did not specify a blueprint for creating an image, but a set of simple "growth" rules.

The opening shot of "Panspermia" shows a lump of something traveling through space. It lands on a planet and shatters into a jillion bouncing jewels of many geometrical varieties and colors. And then some jewels begin to sprout fronds, unfurling courtesy of the same simple rules a fern uses. Other jewels plump into trunks, branch into trees and vines, splurting out leaves and flowers at a dizzying rate. Within seconds, the formerly dead, brown planet is covered with life. Then we zoom into a cannon-shaped plant that seems to be soaking up energy for one great PHLOOT that spits a fat spore, just like the one that opened the scenario, far, far, into the sky.
—Howard Rheingold

Artificial Life II Video

Christopher G. Langton, 1992.

\$64.50 (\$69 postpaid) from Addison-Wesley Publishing Co./Corporate & Professional Division, 1 Jacob Way, Reading, MA 01867; 800/447-2226

LEVY: Well, what I'm saying is that what I hear from the artificial-life community, as it were, is a very strong belief that — certainly not in this generation but not within an inconceivably distant time span — the creations of human beings will compete with human beings and potentially supplant them. That's what I'm hearing.

PACKARD: I fundamentally object to the idea that an evolutionary process can be judged as good or bad.

LEVY: Don't you think that human beings have the ability to control their own actions? I mean,

you can't do something on an individual scale and excuse yourself by saying "Evolution did it!"

PACKARD: But my point, you see, is that the evolutionary scale is inevitably so far removed from the personal scale —

LEVY: But that's the difference here. When artificial life comes to pass, then the evolutionary scale shrinks exponentially.

PACKARD: No, even if we build incredibly intelligent superandroids that are self-reproducing and populate on the planet all over the place, it will still take a couple of generations to —

LEVY: A couple of generations? That's nothing!

PACKARD: Yeah — but what the hell, I'm not going to be around.

LEVY: You're not serious when you say that, are you?

PACKARD: What I'm getting at is —

LEVY: Wait, I want to clarify this. Let me remind you that we're talking in a tape recorder here. You don't really say that "I don't care what I work on as a scientist as long as it doesn't happen in my lifetime." You're not saying that, are you?

PACKARD: No. My point is that

Prisoner's Dilemma

William Poundstone, of *Recursive Universe* fame, again serves up a stew of insight heavily seasoned with seemingly unrelated yet ultimately illuminating material. In this case, the side dishes — a mini-biography of John von Neumann, a brief history of the origins of the Cold War, and a flashback to the ruminations of the Doctor Strangeloves of the Rand Corporation — wonderfully complement the main course: game theory. Specifically, Poundstone seizes on what is known as the Prisoner's Dilemma, a sort of erector set of conflicting stratagems that can be easily blown out of the social-sciences lab and applied to situations in everyday life. (Not only our everyday life, but that of biological species competing over evolutionary time.)

The Prisoner's Dilemma is where you have to decide whether to get along with someone (cooperate) or screw them over (defect). In most cases, it's a two-player game where the best mutual outcome is dual cooperation, but the biggest payoff for the individual comes when the other guy naively cooperates and you greedily defect. If you both defect, neither of you does well.

Even when the payoffs are clear and the strategy seems obvious, doubt creeps in because you never know whether the other guy is going to behave rationally. How one plays the Prisoner's Dilemma is an insight into his world view. And after reading this clearly written, quietly profound book, you'll realize just how

much the Dilemma figures in your life and the world around you.

—Steven Levy

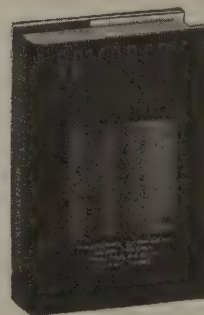
I have now described several instances of the prisoner's dilemma, each ending with an odd contradiction. No matter what course you take, you end up wondering if you have chosen correctly. How should one act in a prisoner's dilemma?

In the main this is still an unanswered and probably unanswerable question. Game theorists R. Duncan Luce and Howard Raiffa, who gave the prisoner's dilemma great emphasis in their 1957 book *Games and Decisions*, wrote, "The hopelessness that one feels in such a game as this cannot be overcome by a play on the words 'rational' and 'irrational'; it is inherent in the situation."

Game theory is not about "playing" as usually understood. It is about conflict among rational but distrusting beings. Von Neumann escaped revolution and terrorism in Hungary and later the rise of Nazism. His relationship with Klara was one of repeated conflict. In his letters to his wife Johnny talks of double-crossing, reprisals, and boundless distrust. That's part of what game theory is about.

Game theory was the brainchild of a cynic. Some commentators have suggested that von Neumann's personality led him to ex-

plore game theory rather than something else. It is wrong to think that von Neumann concocted game theory as a "scientific" basis for his personal beliefs or politics. Game theory is a rigorously mathematical study which evolves naturally from a reasonable way of looking at conflict. Von Neumann would not have pursued game theory had his mathematical intuition not told him that it was a field ripe for development. Some of the mathematics of game theory are closely related to [those] that von Neumann used in treating quantum physics.



Prisoner's Dilemma

William Poundstone, 1992; 290 pp.

\$22.50 (\$25 postpaid) from Bantam, Doubleday, Dell/Fulfillment Dept., 2451 S. Wolf Road, Des Plaines, IL 60018; 800/223-6834 (or Whole Earth Access)

The payoffs (in dollars, francs, casino chips, or any betting unit you like) are:

A cooperates
A defects

	B cooperates	B defects
A cooperates	2, 2	0, 3
A defects	3, 0	1, 1

if you just sit around on the timescale of our lives, or maybe a few years, you get this feeling like nature has a certain harmony. And that it's good not to disrupt this harmony too much. It's good not to pollute the shit out of the planet, and it's good not to destroy each other with atom bombs, it's good to kind of maintain a certain ecological, global harmony. That's good. Okay.

On a longer timescale, not a few years but a few million years, I think there's a different kind of harmony. There's a harmony of an evolutionary process. And this harmony is completely divorced from the existence or the maintenance of a particular species, let alone a particular individual. You and I, we're totally irrelevant, absolutely irrelevant, even on the scale of — we don't have to go millions of years, let's just go tens of thousands of years, you know? You don't remember who the hell your grandfather was 10,000 years ago. You don't give a shit.

LEVY: This is probably true.

PACKARD: And what I'm saying is that there's a certain harmony to the evolutionary process, and I have a fairly strong faith that even with really pretty damned cataclysmic events, that harmony will be maintained. If we could manage to find a way to disrupt that harmony, that's what I would object to. But the evolutionary harmony, because of its timescale, is divorced from individual considerations or even species considerations. All you can talk about is a sense of intrinsic harmony to the process. [That should be] maintained, and what that means I'm still learning. But I think it means a maintenance of a rich availability of future possibilities. And so, as long as what we create maintains that, I'm not going to complain.

LEVY: Why is it exciting to you, the possibility of creating?

PACKARD: I think the reason that it's really exciting to me is because it allows me to participate in this harmony. It allows me to use the computer like an instrument to generate some chords.

LEVY: Aren't you going to be a father soon?

PACKARD: Yeah. I think it's a different phase of the same har-

mony, a different chord, a richer chord, shall we say. But nevertheless a similar participation in the process.

LEVY: Do you really feel, if you get this model done you will be physically a participant in that process?

PACKARD: Yeah. And that doesn't bother me, and in fact I find it kind of exciting and thrilling, rather than something to be avoided. ☺

The Gold Bug Variations

The plot: a Brooklyn librarian is challenged by a young art-historian-turned-data-processor to check out the past of his senior colleague, a reclusive genius. She discovers that he was once a key young biological researcher on the cusp of cracking the code of DNA. What happened to him (and what happens to her as she learns about the man and his obsessions) forms the core of the year's best novel.

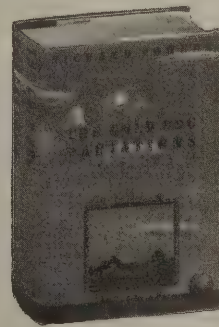
The Gold Bug Variations is above all a Big novel, unafraid to be about something. Since what it is about is no less than life itself, writ on the chalkboard of molecular biology as well as through the clutter of human emotion, it's also an important book. You won't blaze through it — the narrative doesn't race, but trickles out as Powers builds your database of the awesome facts of life — but if you're like me, you'll savor it. It's like a mystic collaboration between Douglas Hofstadter and Anne Tyler.
—Steven Levy

• "Success" mutated from Ur-roots *sub* and *cedere*, to follow after. Its hold on my English mind is a loaded model where B competes with, bests, and replaces A. The word warps my research. Scarcity undeniably demands competition, but living success does not mean beating out all comers. Cooperation of ever tighter skeins ties the web together, interanimates the nets of success. Emerson came remarkably close for an American: "All are needed by each one; / Nothing is fair or good alone." That one I learned as a schoolgirl. Successful hunters are not too good at killing, and successful prey must be pared and pruned.

The word I need is not "to follow after." I need another etymology: parasitism, helot-

ism, commensalism, mutualism, dulosis, symbiosis. Local labels for the ways one solution requires another, from the bribes of fruit trees to the bacteria in my gut. Joint solutions everywhere, from ants and their domestic aphid farms to lichen, a single plant formed of two organisms that feed and water each other, breed and reproduce together.

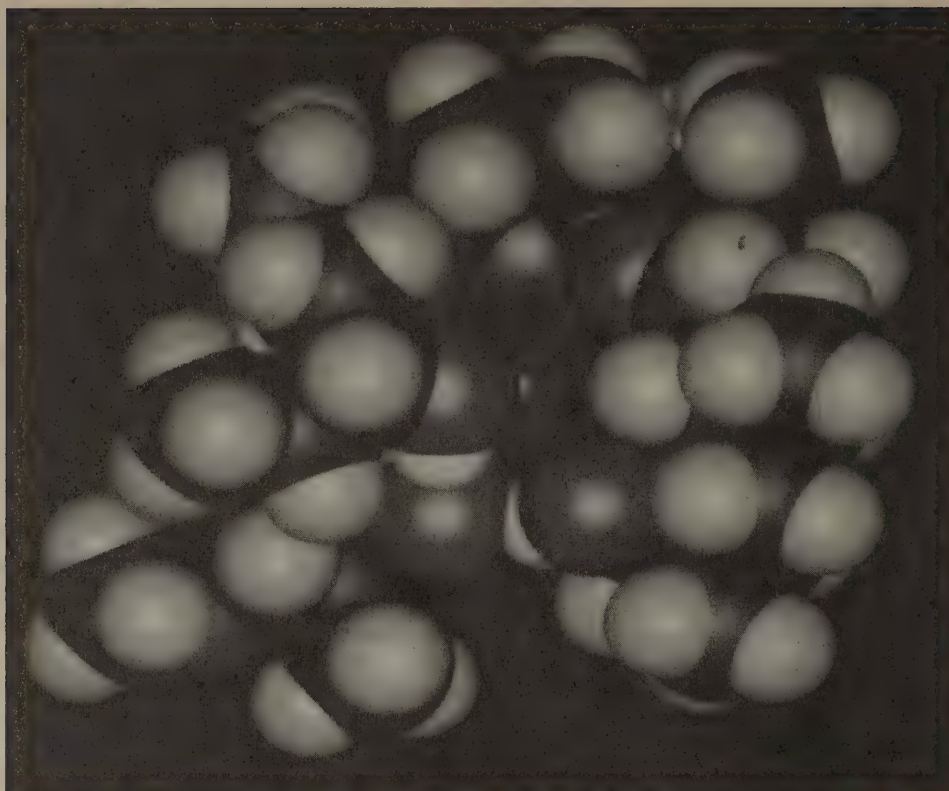
One remarkable night, snowed solidly into a New Hampshire cottage, Dr. Ressler laid it out. "Mimicry is also an interlock. A snapping turtle's tongue depends on the shape of a fly. The beetle that borrows the look of a thorn lives off the rose's solution. Half a dozen harmless snakes ape the bands of a coral without paying to produce the poison. Jammed frequencies of passed semaphores, real, faked, intercepted, abused: everybody trafficking on the river dabbles in this pidgin." His speech was soft because the night was late, the kerosene flame revealed the blanketed world outside, and we knew we were going nowhere the next day.



The Gold Bug Variations

Richard Powers, 1991; 639 pp.

\$25 (\$26.50 postpaid) from William Morrow and Co./Wilmore Warehouse, 39 Plymouth Street, Fairfield, NJ 07004; 800/843-9389 (or Whole Earth Access)



The shaded/solid rendering of monensin sodium, a naturally occurring antibiotic, is based on structural information determined through x-ray crystallography.


Rich Friesner

COmputational CHEmistry

COMPUTATIONAL CHEMISTS ARE ON THE VERGE OF being able to create, on demand, materials that have specific properties, whether of flexibility, durability, or the ability to turn an alluring shade of lavender when the late-afternoon light strikes them at a certain angle.

BY PAULINA BORSOOK

A possibly apocryphal insight (variously attributed to Nobel Prize-winning physicists Paul Dirac, Edward Teller, and others) states, "The work of physicists is finished; what is left is engineering." Dirac, one of the fathers of quantum mechanics, said in 1929 that "The underlying physical laws necessary . . . for a large part of physics and the whole of chemistry are completely known, and the difficulty is only that the exact application of these laws leads to equations much too complicated to be soluble." No chemist has had the time or the means to perform the calculations, so no chemical engineer has been able to use the solutions to build new materials. It is turning out that advances in computer hardware and software may prove Dirac wrong: supercomputers and new ways to use them may finally be able to solve the equations that explain and describe the material universe.



Computational chemists are beginning to make runs at these quantum mechanical equations, now that supercomputers can help relieve the burden of complex calculations. In theory, it is possible to apply the equations to understand precisely how it is that a piece of wood is brown and hard. Once that mathematical solution is understood, it should be a matter of engineering to create other substances that are equally brown and hard.

Until now, in spite of advances in basic science, chemists and biotechnologists have still largely made their discoveries on the basis of empirical methods of trial and error. Computational science could change all that.

Molecular design (as one branch of computational science is called) is already considered to have strategic importance. The Office of Naval Research is bringing together chemists, physicists, engineers, and computer scientists to consider techniques for mastering the material universe at levels never before possible. Computational science will have an immediate impact on quality of life in areas as diverse as animal rights (no more animal testing for drugs or cosmetics), use of natural resources, and workplace safety. The secondary impacts — the way new materials will change our minds and our societies — are harder to predict.

It happened in Tallahassee

A conference (one attendee called it "molecular Woodstock") brought together computational scientists from diverse disciplines at Florida State University in Tallahassee in January 1992. This "Workshop on High-Performance Computing and Grand Challenges in

Structural Biology" felt like being present at the creation of something. The feeling in the air was that of approaching a major threshold in capabilities that scientists have long sought. Computers are finally fast enough for Something Important to happen in several different fields. (Although it pays to remember that Artificial Intelligence [AI] has been threatening to be at a similar threshold for the last 20 years.)

Structural biology, now largely a branch of computational science, is concerned with the physical/chemical structures of biological compounds. Crick and Watson's uncovering of the double-helix structure of DNA is perhaps the best-known example of structural biology. The people who cracked the structure of hemoglobin, the first protein whose structural configuration ("conformation," in structural-biology vernacular) was understood, won a Nobel Prize for their work, too. Yet, thirty years later, scientists are still not exactly sure how oxygen really binds within the hemoglobin molecule — and the binding of oxygen within hemo-


globin is among the most basic physiological functions. As things stand now, it's like not really understanding what it means to breathe, though we still take it on faith that breathe we must. Structural biologists try to figure out similar life processes at the level of physics.

A central problem facing the field of structural biology is the issue of protein folding — understanding (and therefore being able to predict) why proteins, as dictated by the ordering principles of genetic instructions, take the shapes they do in order to perform the functions they have been assigned by nature.

Protein folding fascinates structural biologists and computational scientists from other disciplines because it is a highly visible problem, with huge payoffs for those who solve it. Understanding protein folding is necessary to understand how biological processes work. Once the rather routine mapping from the highly funded, highly publicized Human Genome project is completed, the hard part will begin: knowing how the proteins associ-

ated with a particular gene are biologically active. The same principle, of structure determining function, also applies to research into how drugs take action in the body. In spite of all the leaps in pharmacological research, no one truly understands the specific mechanics of drug action, the particularities of why an effective medicine binds to a particular molecule, and why a similar but ineffective medicine doesn't.

Structural biologists and other computational scientists are



The goal of computational science is to make theoretical breakthroughs about fundamental physical principles by using computers to extend scientists' abilities to deal with complex phenomena. Computational biology is scary enough, as Kevin Kelly's and Steven Levy's articles in this issue demonstrate. Computational chemistry might be equally powerful, promising, and scary, in a different way. What new powers, tools, weapons, and side effects might result when the capability of creating molecules to perform certain tasks on command is translated into technology?

Paulina Borsook is finishing her MFA thesis at Columbia, "a book-length series of interconnected short stories that delineate how the new information technologies (focusing on but not limited to email) deform relationships." The title story of the collection, "Virtual Romance," features the WELL, and was nominated for a Pushcart Prize. She describes herself as "a Luddite who has made a living for the past ten years writing about computers and communications." Her email address is loris@well.sf.ca.us. —Howard Rheingold



drawn to the mysteries behind protein folding. Computational scientists (as do all good scientists) have the sense that if this problem can be posed in an aesthetically pleasing way, an equally aesthetic solu-

tion will be on hand. Particle physicists are migrating to this problem in part because of their traditional attraction to aesthetically pleasing problems, but also because breaking the code of pro-

tein folding at the atomic level, of breaking down into its physics, is a problem that can — and most likely will — be solved. Not so the origins of the universe, the mysteries of time, and where we all came from and are going to. Particle physicists are leaping on the problem of protein folding because so many obvious, elegant, and soluble problems have already been solved in their native field.

OTHER LINES OF INQUIRY IN COMPUTATIONAL SCIENCE

Protein folding isn't the only area of interest for computational scientists. Computational chemistry, as manifested in molecular engineering, hopes to create mathematical models able to predict the behavior of experimental substances. This could change the shake-and-bake process of chemical invention.

Molecular engineering — controlling the microworld — could transform every area of industrial production. With supercomputers and supercomputer software that did not exist as recently as five years ago, theoretical chemists are poised to invent solutions to a number of problems:

- **New products could be designed from the molecular level to be biodegradable. Substitutes for environmentally destructive compounds could be created that work as well as, or even better than, the fluorocarbons they replace.**
- **Solar energy may finally replace fossil fuels. Efficient photovoltaic cells could replace those available today, manufactured from materials designed from scratch at the molecular level to absorb energy from the sun.**
- **Metal alloys can be created that could, for example, make jet engines simultaneously far more powerful, lighter, and safer.**
- **Drug design could allow pharmaceutical companies to assess the usefulness of candidate medicines long before they are tested on human subjects.**
- **New methods of catalysis (speeded-up chemical reactions used in ordinary manufacturing processes such as the cracking of crude oil to make gasoline) can be achieved through mathematical modeling. Each new process so discovered is potentially worth billions of dollars.**
- **Polymers, the basis of plastics and other synthetics, can be custom-designed to achieve specific ends. At last, pantyhose that really won't run!**

Dimensions of the problem

There are from anywhere from 60 to 500 constituent amino acids in a particular protein, with the sequences of the amino acids determining its structure. With sickle-cell anemia, for example, the difference between one amino acid being present as opposed to another makes the crucial difference in oxygen uptake — and serious illness in the life of the sickle-cell-anemia sufferer. Scientists as yet can't predict the three-dimensional structure (conformation) of a protein from the sequence of the amino acids in it.

Each amino acid is at an angle relative to the next one in a sequence. Initially, conformations were sought experimentally through x-ray crystallography, but scientists prefer the intellectual satisfaction that would come from finding an overarching principle that would generally predict conformations. Further, making crystals is a black art, not a science, and there are whole classes of proteins, such as those embedded in the fatty ripply media of membranes, where it is almost impossible to create crystals. Hence the current turn to computers to seek a general principle of protein folding.

Theoretically, there are about five different possibilities for the difference in position from one amino acid to the next; extrapolate this, and you have a fine computational problem to be solved,



for there could be 5-to-the-100th-power different variations of amino-acid angle variations for a particular protein. No computer on the market today (or projected to be around in the not-so-near future) could run through this many iterations to find what the conformation would be for a protein. Which is where things get interesting: researchers are attempting to narrow the search through the creation of clever software algorithms.

Computational scientists have ideas, of course, on how to prune the search for likely conformations. Some use familiar computational methods, such as decision trees, or Monte Carlo, a computer program that takes all the known information about a physical system and systematically and repetitively introduces an element of chance

(hence the name: like rolling the dice at Monte Carlo) into the model created by the data and probabilities fed into it. AI has also been thrown around as a way to solve the problem.

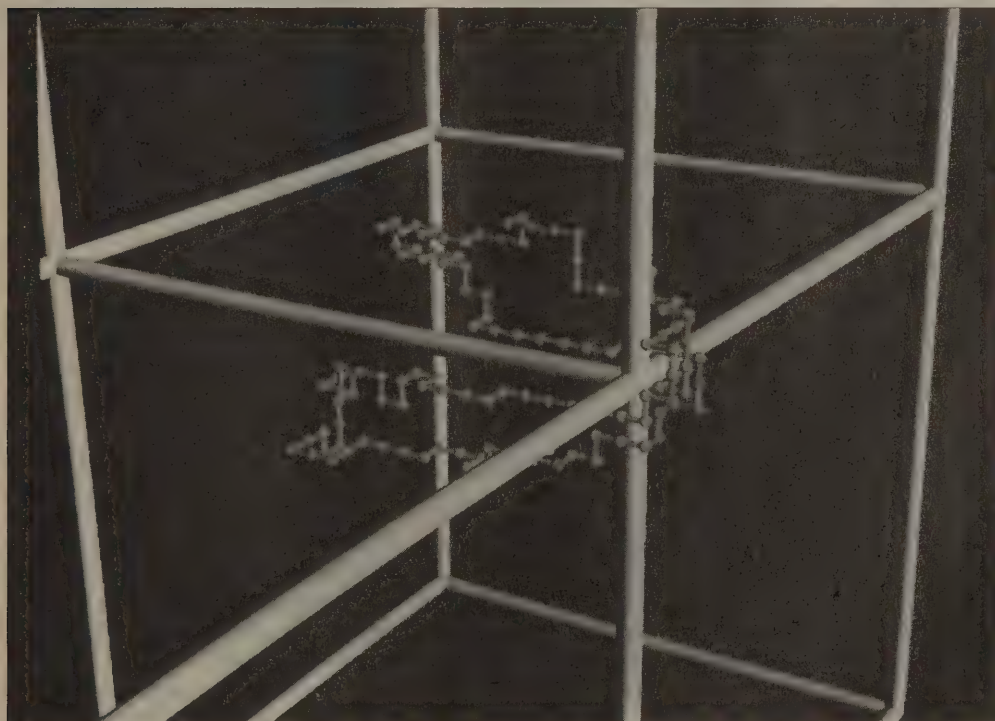
More interesting, Peter Wolnyes, a scientist at the University of Illinois, has a more interdisciplinary approach. He borrows from neural-networking models of how the brain works, using the 500 or so protein configurations already known, to reason by analogy. His novel method brings prior information into the search, creating a learning algorithm.

Everyone devoted to the problem seems to have a different intuitive sense of how the search ought to be pruned. The feeling at Tallahassee was that computer hardware had

improved enough in the last ten years and that massively parallel machines have finally matured enough, that somebody might happen on a truly interesting solution in the next year or so.

The birth of a new science

The conference in Tallahassee was expected to attract 50 people; more than 300 came. The birth of a new science was evident in several regards: structural biologists, with their concerns about algorithms, and discussions of energy fields, had more in common with physicists than their more traditional colleagues in evolutionary biology or in field ecology. Biologists, chemists, physicists, and computer scientists were speaking a common



In gel electrophoresis, electrical potential applied to DNA fragments placed in a gel causes the fragments to move through the gel and separate by size.

This schematic shows a knotted DNA fragment within a gel, with the gel represented as a regular lattice. Simulating gel electrophoresis helps researchers better attack the cataloging of the functions of the thousands of genes found in the human cell.

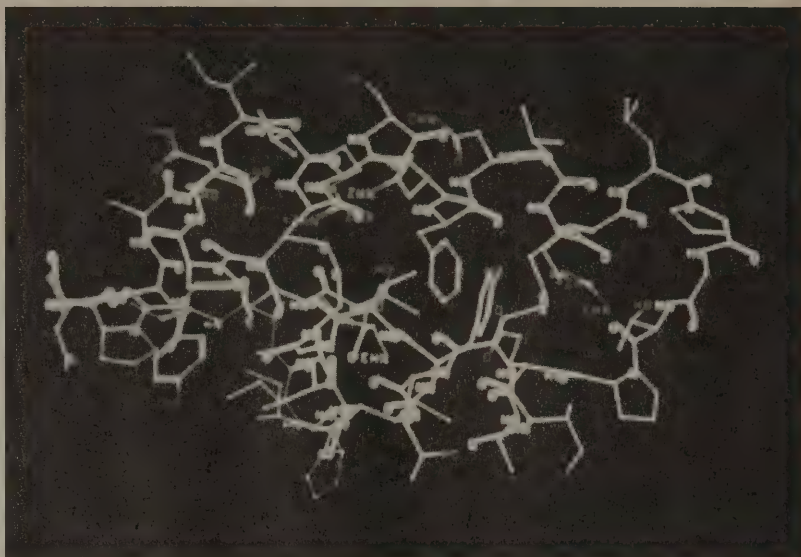
E. J. van Rensburg, Hwa Lim, M. T. Carroll, FSU

language of problem-solving through modeling on supercomputers.

The conference also raised the hot issue of big science and little science, centralized versus distributed computing. Some of the most passionate argument centered on whether, in a time of decreased national funding for research and development, an effort should be made to lasso \$20 million for a nifty new supercomputer, or have that money put into having the equivalent of a Sun or Silicon Graphics workstation on every grad student's and every post-doc's desk.

The people who want the supercomputer say that there are kinds of problems that can only be solved by big iron; that having access to the unique ways massively parallel machines solve problems will create new understandings and new ways to try to understand reality; that those who have never played on one of these magnificent instruments cannot appreciate the difference a Cray or Kendall Square or Connection Machine would make. ["Traditional" supercomputers use one very powerful processor that processes many instructions "serially" — one at a time. "Massively parallel" supercomputers use thousands of relatively less powerful processors that operate simultaneously — "in parallel." The use of large numbers of less powerful processors makes it possible to produce supercomputers at much lower cost — "desktop supercomputers."] The best and brightest scientists say that the best science gets done when scientists know how to make use of new technologies, leaving behind endless recapitulations of what they learned in grad school. They say, bring on the supercomputers.

Yet the genius of the microcomputer revolution (and the way some of the most intellectually interesting science has historically gotten done) has been by someone noodling around in a modest, relatively low-tech fashion. Personal computers



Rich Friesner

The main value to computational chemists of crambin, a very simple protein, is its simplicity: crambin was one of the first proteins whose structure has achieved high resolution at the atomic level. This visualization was done on a Silicon Graphics workstation.

gave individuals routine access to computing power. Funding for access to a pricy new supercomputing center necessarily means that only certain people can use that computer time, in rationed amounts — and the question remains, with fiscal technology policy being what it is in the US: might that money be better spent letting graduate students try out their ideas for the minimal price of a piece of small-scale local hardware? No supercomputer center overhead costs, no telecommunications charges, no competition for scarce computing time with folks from other universities. The power to solve the problem would remain on the desktop.

Still, revolutions in technology are as much about changes in toolmaking as they are about the creation of Wonder Widgets. Think of the zillions of toolmaking innovations that had to take place in order for the automobile to hit the road with any reliability and force. Since software is the tool of this technological revolution, it might well be true that it is only on big, massively parallel machines that the new tools, and new ways of doing business,

can be created to attack the problems of computational science (see sidebar, p. 50).

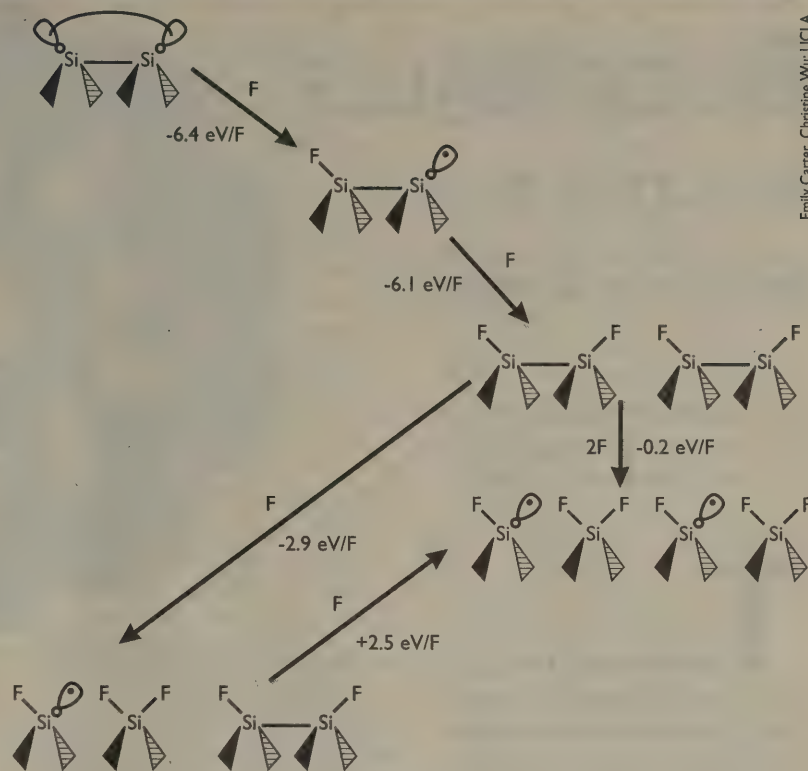
This problem of toolmaking is related to a curious blending of research and commerce unique to the field. Supercomputer companies, most notably Thinking Machines, have on staff Ph.D.s whose jobs involve cranking out papers and doing research on computational problems in physics, chemistry, and biology, as well as servicing accounts and tending to customers' needs. The synergy appeals to academic scientists: at last, they think, computer-company staffers who speak our language and can understand the problems we are working on. But the covert marketing message this sends is that the presence (and publication histories) of scientists on staff at the computer companies are existence proofs that the machines can be used to solve problems similar to those academic researchers are struggling with. This matters supremely in this new field of computational science and with this new technology of massively parallel machines: regardless of what vendors say, programming

and software development for these new machines is, as the scientific jargon goes, not trivial. And scientists take comfort in the indirect assurance that the machines can be made to work and that functional software-tooling is at hand.

Predictably, venture capital is flowing into the field — but interestingly enough, it is into the companies creating the software tools. The market for these tools is already grossing around \$50 million per year, and there are already mergers and acquisitions of these toolmaking companies.

As usual, there is a potential downside to the fine invisible hand of capitalism. Will the dictates of private enterprise determine what kinds of problems get worked on, and which ones get slighted? Further, this is a field in which petrochemical and pharmaceutical companies have invested large amounts of money from the very beginnings of computational science — so the question remains whether the free flow of scientific information will be affected by the hybrid mixture of basic research and commercial investment. Will unfavorable results not be reported? If an in-house scientist doing molecular modeling for a drug company solves the protein-folding problem, for example, will patent concerns prevent word from getting out?

Regardless, computational science is poised to take off the way biotechnology did ten years ago. Even *Business Week* did a recent cover story on the topic (titled "The New Alchemists"). Professionals in the field, the academics researching these frontiers, are beginning to form companies capitalizing on the means to predict and design the behavior of any new compound desired by science, industry, or 100 well-trafficked shopping malls across the country. And the Tallahassee conference has spawned a task force charged with trying to wrest money from Congress to support this Grand Challenge in Struc-



Fluorine atoms reacting with a silicon surface — an important general chemical reaction because it is the basis for all computer-chip technology. Computer chips are etched with fluorine to create integrated circuits. The manufacture of chips has become sufficiently advanced that patterns can be etched at the level of submicrons; it has thus become critical to understand what goes on at the atomic level. Once that understanding is achieved, integrated-circuit patterns could be created at the atomic level, accelerating the miniaturization of computer technology.

Here, silicon bonds are being broken and silicon-fluorine bonds are being formed. Computational chemistry on an FPS Computing model 521-EA superminicomputer solved the equations that created this model.

tural Biology that, they argue, can only be met by funding a super-computer center.

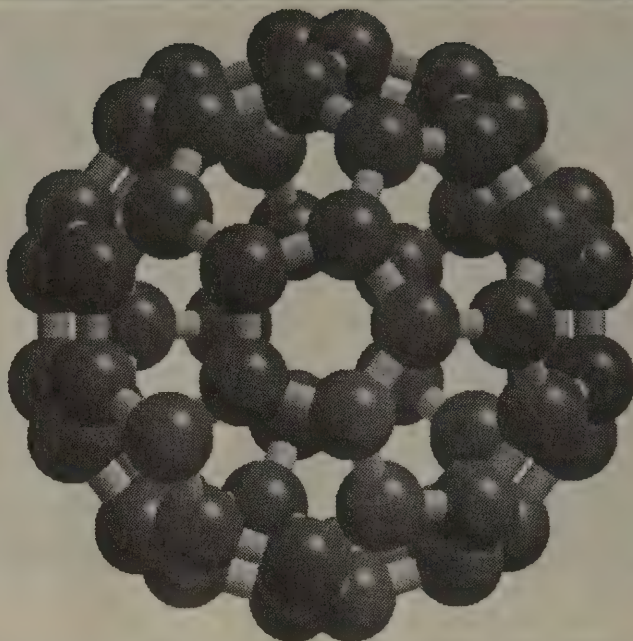
In the short term, physical chemists wonder if, to get the support to develop the software that will underpin the twenty-first-century industry of alchemy, they'll have to beg for a Big Science project like a Structural Biology Supercomputer Center, instead of simply being able to ask for more funding for more support for more graduate students who will use more workstations. Meanwhile, computational chemists feel they may be able to deliver

on the promise that nanotechnology has been making: engineering in the microworld. And if they succeed, they may overturn our entire post-industrial way of life: if diamonds or gold or what appears to be clear-heart redwood can be manufactured as easily as plastic wrap is now, then the dream of enough of everything for everyone might be achieved. Money and material wealth might become something very different, but chemists, or whoever employs them, would become the new Lords of Creation. And that could be pretty scary. ☹

BUCKYBALLS

WIDE-OPEN PLAYING FIELD FOR CHEMISTS

BY ELIZABETH CULOTTA
AND DANIEL E. KOSHLAND, JR.



THE ROUNDEST, MOST symmetrical large molecule found so far, buckminsterfullerene, continues to astonish with one amazing property after another. Named for American architect R. Buckminster Fuller, who designed a geodesic dome with the same fundamental symmetry, C₆₀ is the third major form of pure carbon (graphite and diamond are the other two).

Fuller claimed that his geodesic designs were a reflection of a fundamental cosmic structure; it took a half-century for chemists to catch up with that idea. Buckyballs are where Bucky Fuller's mind-children meet computational chemistry.

This article was originally published in Science, the research publication of the American Association for the Advancement of Science (Volume 254, p. 1706; December 20, 1991).

—Howard Rheingold

Buckyballs were discovered in 1985 — the by-product of an experiment on carbon molecules in space — but in 1991, buckyball science came into its own. Scientists flocked to the buckyball court, entranced by the molecule's unusual bonding behavior, its hollow symmetry, and its amazing electronic properties. Rarely has one molecule so swiftly opened the door to a new field of science.

Papers now hit top journals every week or so; scientists scramble to keep up by fax and email, and month-old information is probably out of date.

In the past year, properly doped C₆₀ was found to be both superconducting and magnetic, and the fullerene family expanded to include asymmetrical forms as well as cylindrical fibers (nicknamed buckytubes). In a steady stream of firsts, fullerenes were found in flames, decorated with free radicals, hung with fluorine atoms, inflated by carbon rings, and stuffed with metals. With potential applications in such commercial basics as catalysis and polymerization as well as the more distant realms of superconductivity and ferromagnetism, buckyball may soon be one of industry's favorite sports.


Although C₆₀ is still relatively expensive — at least \$2,000 per gram in purified

form — many predict that fullerite (the pure, solid form of C₆₀) ultimately will be a bulk commodity, sold in local chemistry supply stores for dollars per pound.

Just how do buckyballs manage their chemical and physical feats? In C₆₀, hexagons and pentagons of carbon link together in a coordinated fashion to form a hollow, geodesic dome of bonding strains equally distributed among 60 carbon atoms. Some of the electrons are delocalized over the entire molecule (a feature even more pronounced in that workhorse of organic chemistry, benzene). But benzene is flat, and many of its derivatives also tend to stack in flat sheets. Spherical buckyballs literally add a new dimension to the chemistry of such aromatic compounds.

The allure of C₆₀ goes beyond the beauty of its symmetrical shape. First considered a paragon of physical stability, it has turned out to be one of the most chemically versatile molecules known. This year, among other pioneering steps, chemists learned how to make fullerene derivatives, inflating the C₆₀ balloon by one or more carbons, in some cases still preserving its aromatic electron structure. In the same week, it was reported that C₆₀ acts as a veritable sponge for free radicals, able to absorb dozens of these reactive chemical species. Free radicals with one unpaired electron

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are crucial to the economical polymerization processes, and fullerene compounds may one day be useful in such industrial processes.

A simple C60 cage easily accepts electrons, so solid fullerite doped with an alkali metal like potassium forms a stable compound of the family called fullerides with increasing amounts of the alkali metal. Some fullerides become chameleons, changing from insulator to semiconductor to superconductor and back to insulator again. Pure C60, for example, is an insulator; K3C60 is a superconductor; K6C60 is an insulator. The superconductive properties have unfolded at astonishing speed. In April, the critical temperature was 18° K; by November, maybe 45° K, thanks to novel dopings of C60 and its rugby-ball-shaped cousin, C70, with metals and alloys of rubidium, cesium, and thallium.

The fullerides can't yet run in the same league as the traditionally hot candidates for high-temperature superconductivity, the metallic copper oxides, which have set the superconductive record at about 125° K. But because the fulleride materials are a much simpler system, they may offer a window into the still-mysterious mechanisms of superconductivity.

Ferromagnetism, like superconductivity, remains a mysterious electronic property of certain materials. This year, buckyballs proved that they can play magnetic games too. Add an organic reducing agent to fullerides: the totally unexpected result is a "soft" organic ferromagnet at temperatures of up to 16° K. The new material won't stay magnetic in the absence of an outside field, and so may not in itself have practical applications. But the ongoing quest for an organic ferromagnet, which would be prized for its light weight and ability to be polymerized, suddenly broadened its scope to include the fullerenes.

For years, chemists have been painstakingly building molecules with cavities and fine-tuning the properties of those cavities in order to hold and transfer different atoms and ions. Now, with a naturally hollow molecule dropped into

their laps, chemists are eagerly discovering the rules for how buckyballs can be filled. By combining approaches, chemists may eventually tailor-make stuffed buckyballs to serve as molecular containers, shields for radioactive compounds, or drug-delivery agents. This year, lanthanum atoms were stuffed inside buckyballs using the ship-in-a-bottle trick: form the cage around the stuffing. The next goal is to open a door into the fullerene cage, while preserving its fragile electron structure, to allow direct movement of atoms or ions inside.

Not all of the fullerenes have the perfect symmetry of C60 — but even a lopsided structure can be promising. C76 and C84 have been found to have a helical form. C78 also has a chiral* form. Starting with planar graphite and ending with chiral carbon is surprising enough, but the asymmetrical forms may have fancy applications too, such as the creation of nonlinear optical materials. When exposed to light of one frequency, such a material would emit light of another, acting as an optical switch.

One of the year's most exciting developments turned up in the dirt-piles of old fullerenes. In the soot on a carbon electrode used to make fullerenes were found needles of carbon, composed of very thin nested tubes. Within each individual rolled-up sheet, the carbon molecules were apparently arranged in a helical structure. Fullerene tubes may possess an amazing mix of properties — including great strength, since fibers of conventional forms of carbon are already the strongest known. Evidence is mounting that the higher fullerenes — such giant molecules as C240 — may not be symmetrical like the prototypes, C60 and C70. Rather, the larger molecules may be asymmetrical and incorporate buckytubes in their structures.

Carbon cages are likely to make good catalysts, thanks to their bonding behavior and geometrical features, so industrial chemists are watching the buckyball

play closely. This year, the outsides of carbon cages were decorated with complexes of nickel, palladium, and platinum, a feat that may eventually offer more than just a pretty molecule.

Many potentially useful organic compounds have a crippling fault: they tend to be intercalated into DNA, and thus to promote cancer. But buckyballs suffer no such flaw. They appear to be too big and round to be incorporated into DNA as are some of their planar cousins.

Buckyballs face a potential red flag of their own, however. In the presence of light and oxygen, the C60 molecule can pass its superfluous excitation energy on to nearby oxygen molecules, creating a long-lived but very reactive form of oxygen called singlet oxygen. Bucky boosters point out that even such a threat may hold promise. When not in an excited state, C60 quenches the reactivity of other singlet oxygen species. Unmodified fullerenes are insoluble in water, suggesting that they may react very little with biological tissue. Carcinogenicity tests are ongoing, but thus far buckyball looks like one of the safer games in town.

As fullerene science takes off in all directions, speculation as to its uses abounds. Will it be superconductivity that makes fullerenes commercially important? Superstrong fibers? Catalysts? Too soon to say, but buckyball players aren't exactly worried about a lack of applications. At this point, the heady atmosphere of discovery is too strong. After all, so far fullerene science exhibits the classic profile of a major scientific breakthrough. Buckyballs were found by accident, by researchers asking a completely different question. Then they were steadily explored — until they became widely available and the field exploded. Now, buckyball scientists are enjoying the exponential phase, in which almost everything is new and the unexpected is expected. Eventually, the action will focus on a few promising research veins, and the practical applications will bloom. For now, chemists, physicists, and materials scientists are simply having a ball. ☺

* Having the quality of "handedness" — that is, being distinguishable from its mirror image.

Trinity's Children

Interstate 25 — America's "Nuclear Highway" — begins in the high desert of southern New Mexico, not far from Trinity Site, where the first atomic bomb was exploded. It stretches north, past the Sandia and Los Alamos National Laboratories (where nuclear weapons research continues, heedless of the "Peace Dividend"), past NORAD Headquarters in Cheyenne Mountain and the post-Reagan economic disaster of Colorado Springs; past the Rocky Flats Weapons Plant (plagued by three decades of accidents, plutonium releases, and DOE cover-ups), to its ending in the Wyoming prairie — windswept, desolate, and dotted with ICBM silos.

Bartimus and McCartney tell the stories of some of the people who live along this highway and the impact that the nuclear weapons industry has had upon their lives. Their approach is intimate and anecdotal, alternating stories of lost ranch land and poisoned employees with tales from "inside the fence" — the point of view of the soldier, the scientist, the entrepreneur. The authors attempt to present a balanced picture, but therein lies the main flaw in this work — their efforts in the interest of "fairness" rob the book of focus and power, and it is still clear that the authors' sentiments lie with the displaced ranchers, the poisoned workers, the terrified mothers. Nevertheless, the stories are carefully collected and lovingly told, and although they are held to rigorous standards of accuracy, there is a feeling to their presentation that is reminiscent more of folk history than journalism. Highly recommended for anyone interested in the intersection of Big Science, the military, and the defense industry with civilian life. —Daniel Marcus

The missile range, [White Sands technical director James] Wise believes, doesn't stand a chance of going out of business no matter how much peace breaks out around the world. The United States will always be testing new weapons and will always need a place to do the testing. Budget cutbacks have already forced the Army to shoot less and measure more, Wise said. But no matter how sophisticated computer simulations become (and experts can simulate just about any kind of war you want on computers now), there will always be some who want to see the fiery explosion, want to see the thing, whatever plane or missile or gun or laser it might be, actually work. They have to hear the boom.



Pieces of Trinitite found at ground zero.

Another legacy of the fervor of the Manhattan Project carried over to Rocky Flats — worry about production first, safety second. It was not until 1955 that Denver had an inkling of what it had got itself into. The Rocky Mountain News disclosed for the first time that the facility used dangerous radioactive materials.

Not until 1957, the year when Jan Pilcher was having her Brownie troop meetings, did residents get a firsthand look at just how dangerous it all was. A fire ignited by plutonium spread rapidly through a plutonium processing building, causing an explosion that rocked the building, blew out hundreds of ventilation filters, destroyed radiation monitors on smokestacks, and threw thick plumes of black smoke into the air. The smoke passed over Denver for twelve hours after the blaze. The government reassured a trusting public that little or no radiation had escaped, even though officials knew the stack monitors were destroyed. Six months later, a report kept secret at the time found more than eight thousand times the normal "background" level of radiation at a nearby ranch and two elementary schools. But nobody was told, and no cleanup was initiated. A later government report on the fire, also kept

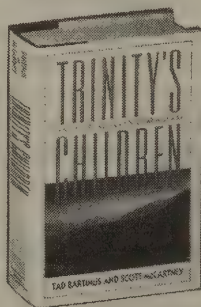
classified until recently, had an ominous unsigned margin note: "Anybody like to guess how much was released?"

The Threat At Home

That old slogan about "bringing the war back home" gets a scary updating in this look at just what the military has been dumping into the ground at bases throughout the US. As a subject, domestic military pollution sounds both boring and terrifying, but Shulman makes it interesting because he lets the people involved tell the story. If you have a military base for a neighbor, or one is anywhere near where your drinking water comes from, this book might make the hair stand up on the back of your neck.

The bad news is that the military has operated outside environmental laws with a really arrogant attitude about what it can do. The good news is that the clean-up has begun, and as an organization, this one knows how to follow orders. —Richard Nilsen

Even when the Johnston Island prototype project is complete, the vast bulk of the chemical demilitarization will lie ahead. The weapons to be destroyed on Johnston Island (including those from Germany) total less than 7 percent of the U.S. chemical weapons currently slated for destruction. The current plan calls for the other 93 percent to be incinerated at eight locations in the continental United States — at military facilities in Alabama, Arkansas, Colorado, Indiana, Kentucky, Maryland, Oregon, and Utah. The Army's decision to build the eight U.S. facilities is based on the fact that unstable, corroding weapons are too dangerous to transport in large numbers. In truth, however, such large amounts of the chemical agents are currently stored at each of these locations that their quantities alone merit separate incinerators: the largest stockpile, at Tooele Army Depot, not far from Salt Lake City, Utah, harbors more than 10,000 tons' worth of chemical weapons.



Trinity's Children

(Living Along America's Nuclear Highway)

Tad Bartimus and Scott McCartney, 1992; 326 pp.

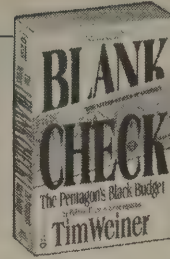
\$21.95 (\$23.70 postpaid) from HBJ Trade, 465 S. Lincoln Drive, Troy, MO 63379; 800/321-5068 (or Whole Earth Access)

Blank Check

The black budget is the secret stash of the American government. It pays for the secret research, the clandestine weapons programs, and the covert wars that the president wants concealed from the American people. It began with the Manhattan Project, grew steadily during the Cold War years, and exploded during the 1980s when the Reagan Administration pulled out all the stops in pursuit of the slippery, perilous grail of nuclear superiority. "By 1989," Weiner writes, "it had grown to \$36 billion a year. It was bigger than the federal budget for transportation, twice the cost of

the Education Department, eight times more expensive than the Environmental Protection Agency. It was bigger than the military budget of any nation in the world, except the Soviet Union's."

If the White House still has an "enemies list" (which it surely does), then Tim Weiner's name is almost certainly near the top. **Blank Check** is based on the Pulitzer Prize-winning **Philadelphia Inquirer** series on national security, secret weapons, and secret wars. It unrolls like the plot outline of an espionage thriller, but the stark truth, carefully referenced and calmly told, is outrageous

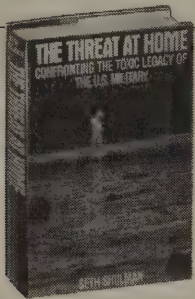


Blank Check

(The Pentagon's Black Budget)

Tim Weiner, 1991; 273 pp.

\$11.99 (\$13.74 postpaid) from Little, Brown & Co./Order Dept., 200 West Street, Waltham, MA 02154; 800/343-9204 (or Whole Earth Access)



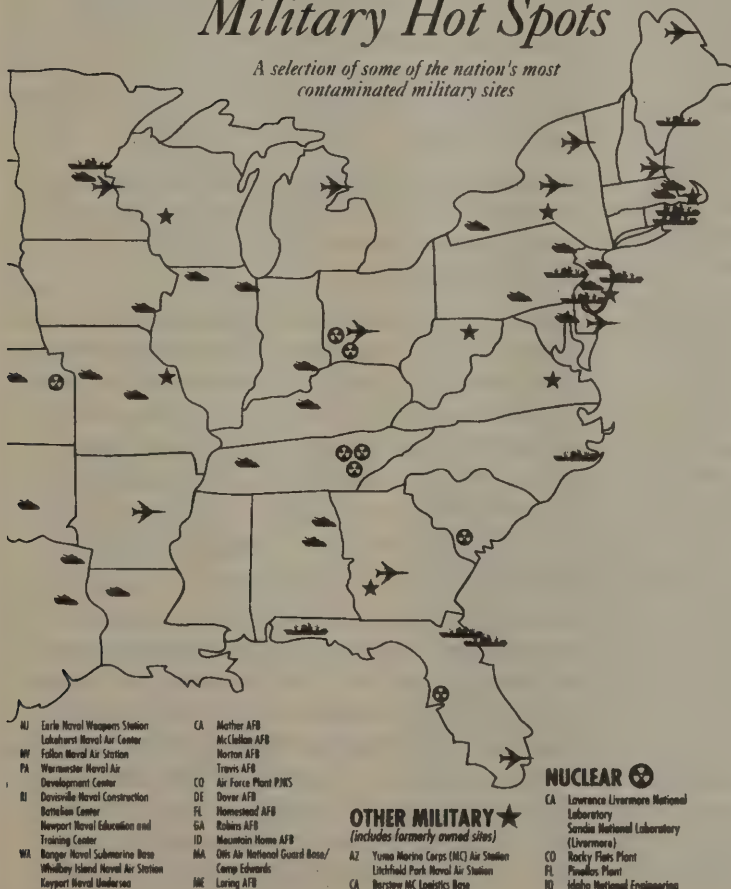
The Threat At Home (Confronting the Toxic Legacy of the U.S. Military)

Seth Shulman, 1992; 254 pp.

\$23 (\$25.75 postpaid) from Beacon Press, 25 Beacon Street, Boston, MA 02108; 617/742-2110

Military Hot Spots

A selection of some of the nation's most contaminated military sites



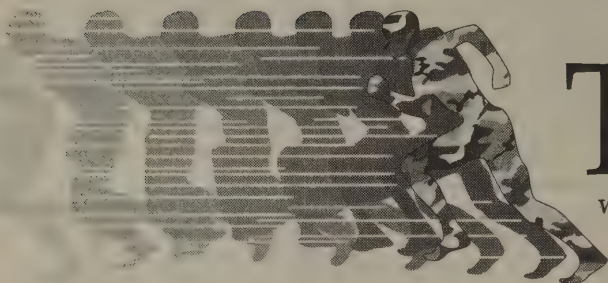
beyond fiction. It is the story of a nation within a nation, unanswerable to Congress and the American people, of scandalous waste and shameless greed, of the incredible arrogance of power. It is thoroughly frightening. —Daniel Marcus

■ The power of nuclear weapons grew far faster than the ability of the human mind to control the weapons in battle. Today the nation's nuclear weapons contain the equivalent of seven thousand billion pounds of TNT, ten pounds of radioactive explosive for every pound of human flesh on earth. For all the years the Pentagon strengthened and rebuilt the nuclear arsenal, expanded and refined its war plans, all the money and all the minds in America never created a system that could command and control nuclear weapons in a real war. What the Pentagon created instead is a mammoth creature with a primitive brain — "an enormously complex but stupid organism," as Paul Bracken, a leading C³I analyst, describes it — a rough beast whose awesome power far outstrips the ability of men to command it.

■ The debate over the Stealth's mission, over why it was needed, over what it might cost, had come far too late. The silencing of that debate for a decade meant that the technology had no policy to justify its existence. As the plane made its debut, a realization was dawning on its creators: the enemy, and the threat it represented, was beginning to disappear. The rationale that brought the Stealth into being was vanishing; the thinking that had shaped it was outmoded. The bomber faced a future in which it might soon be an irrelevant relic, doomed to gather dust in a top-secret hangar. The Stealth, for all its twenty-first-century technology, was an anachronism. This most modern weapon belonged to the past.

ARMY GREEN

BY STEWART BRAND



THE ARMS RACE is running backwards. NATO is without a mission. The few Communist governments that haven't crumbled have turned inward. In the absence of a Soviet-scale threat, present or foreseeable, what is the US Defense Department supposed to defend in the coming decades? What are we supposed to do with the prodigious instrument that won the Cold War and encored with a dazzling victory in the Gulf? That is the deeper debate these days around the Pentagon, accompanying the immediate issue of how to scale down severely and gracefully.

Meanwhile a famous global problem, the deteriorating natural environment, is gradually being re-understood in economic terms. America is finally becoming alarmed about the decay of its engineered infrastructure — highways, water systems, communications systems, and even the education system. In the same way, the whole world is worried about the *natural* infrastructure — soils, aquifers, fishable waters, forests, biodiversity, and even the atmosphere. The natural systems are priceless in value and nearly impossible to replace, but they're cheap to maintain. All you have to do is defend them.

The natural and engineered infrastructures together constitute the world's economic infrastructure — the ecostructure.

Suppose our military took on the long-term role of protecting the global ecostructure. From one point of view it did so in the Persian Gulf, defending the world's access to the major source of inexpensive energy when US direct interests in the region were relatively limited. Could we build on that success? When the global economic infrastructure is understood as including natural infrastructure, we might defend rain forests and diverse ecosystems for the same reasons we defend freedom of the seas and global communications.

An example which has scarcely been reported: tropical hardwood such as teak is a global renewable resource being criminally squandered. Environmental groups are acutely aware of the issue and acutely powerless to

do anything about it in some places, such as Burma ("Myanmar," but who expects the name to last?). Would a threat of UN-sanctioned military intervention keep the vandal government of Burma from selling off its hardwood forests and its people's future livelihood? The idea seems unthinkable now. A few years from now it may seem unthinkable *not* to take action.

But seldom does environmental protection need to be that militaristic. Is there any reason to believe the military would be good at the mostly gentle role of environmental steward?

A rare federal hero of environmentalists these days is, of all things, the Army Corps of Engineers. In the last fifteen years the Army Corps has reversed its behavior, from destroying wetlands, channelizing rivers, and marching roughshod over local conservation interests, toward increasingly creating wetlands, restoring rivers, and responding to local conservation calls for help. All this from an agency that started with no environmental mandate at all.

By contrast, the recent record of federal agencies directly charged with solving serious environmental problems is more mixed. The Environmental Protection Agency's toxic-cleanup Superfund is bogged down in escalating legal costs of a scale to threaten the national economy. The National Park Service is facing its own infrastructure breakdown, having deferred maintenance on basic facilities so long that repair work often consists of "painting the rot." In

the Forest Service, programs for actively preserving public lands are constantly being proposed by staffers and just as constantly shot down in Washington for interfering with commercial interests (cattle, timber, mining) in the National Forest system.

How can that happen? It has to do with expectations. People expect *positive and immediate* results from agencies like the National Parks, Forest Service, and EPA — happy vacationers, income, cleaned-up toxic sites. No one has positive or immediate expectations of the military, only negative, long-term ones — keep war from our land at home and our interests abroad. Environmental problems are best addressed in similarly negative, long-range terms — keep the natural systems from crashing. Such slow, preventative programs are evidently better run by career officers, as in the Army Corps, than by political appointees, as in the EPA, National Parks, and Forest Service.

An element in the military's favor for an active environmental role is its experience in making radical programs work by sheer decree. Way back in 1948 President Harry Truman declared that the US military shall integrate the races in its ranks, starting now. The Pentagon took a deep breath, saluted, and complied, the first and most powerful of American institutions to integrate. A man of Colin Powell's abilities as head of the Joint Chiefs of Staff was a natural result. The same occurred with giving the sexes equal opportunity in the military, a fact overlooked by the public until the Gulf War but long lauded by studious feminists such as Betty Friedan.

If there is an example of socialism that works in the world, it is the US military, capable of carrying out large, slow missions, funded by the seething market economy it protects. I saw it work during two years of active duty as an Army officer in the early '60s. You have job security, lifetime benefits, and a relatively money-free personal economy. You go where you're told and do what you're told, and you feel surprising personal freedom from the gibbering

options and threats of American civilian life. You can relax and do your job, and often the job you do makes you proud.

Following the Gulf War, the US military is bursting with pride and a sense of competence to undertake any task. It prefers humanitarian tasks, such as defending Kurds or aiding Bangladesh typhoon victims. But America has a habit of forgetting its military between wars and giving it no assignments besides laying low and being ready. So the talent and the money get spent on training (with a side-benefit of public education) and on weapons systems (with a fractional side-benefit of technology transfer).

Occasionally a rogue program such as the old ARPA — Advanced Research Projects Agency — puts a few million dollars into a long-term-benefit program such as basic research in computer science in the early '60s. That single project gave America a ten- to twenty-year lead on the world in computer technology and led directly to the personal computer revolution and its associated economic boom (and also a lower-casualty victory with smart weapons in the Gulf). The perhaps lamentable fact is that the best funder of basic science in Washington is the Pentagon. Environmental science needs money — long-term, reliable, large scale money. Where could it be better spent to protect the world from war over the long run?

Military people are public servants, dedicated to the point of risking and sometimes losing their lives — it is called "the service." A frustration I remember of military life is not being called upon to actually serve the public very often; you feel a keen regret for all that ability going to waste in variations on the exercise of digging holes and filling them in. My platoon could have made short work of restoring a salmon stream, assisting a controlled forest burn, helping protect African wildlife from poachers, or planting native shrubs at the edge of a growing desert. I wonder if they might get the opportunity. ☘

BACKGROUND OF THIS PIECE

*Trained as a biologist and an infantry lieutenant, I've seldom had a chance to combine those two clarifying fields. The idea for this piece came up in conversation with a staffer at the Sierra Club who was lauding recent efforts of the Army Corps of Engineers. I worked up the text last year, originally for the Global Business Network, which I co-founded with Peter Schwartz and others in 1988 (his recent book *The Art of the Long View* summarizes what GBN is up to in terms of long-term strategic planning).*

Schwartz suggested I send the piece to Time magazine. The "Time Essay" editor was intrigued and asked to hold on to the article for a couple of months while he tried to slide it through the system. He offered a handsome kill fee if it wasn't used which didn't take me long to agree to. After a few months went by, the nice check from Time arrived, and I showed the piece to an editor of the New York Times op ed page. He liked it, suggested revisions, which I made, and he showed it to the senior editors, who said no. A similar sequence happened with the Washington Post, even though it was one of their random months when they like the military.

So, what the hell, I showed the piece to Howard Rheingold. He didn't have to ask anybody's permission to run it. — SB

The Code of the Warrior

The past twenty years or so have seen a growing interest in our heritage of warrior traditions, especially those of Asian and American Indian origin. Business leaders study Musashi's *Book of Five Rings* and implement win-win strategies; American military leaders quote from Sun Tzu's *Art of War*. There has been a corresponding growth of interest in the spiritual side of warriorship, including the Zen roots of Bushido, Castaneda's books on American shamanistic warriorship, and the Shambhala Training classes presented by Chögyam Trungpa Rinpoche inspired by the Central Asian warrior tradition. Most recently these issues have been taken up by the burgeoning men's movement, as manifested by Robert Bly's *Iron John* and Sam Keen's *Fire in the Belly*.

In *The Code of the Warrior*, Rick Fields (*Chop Wood, Carry Water, How the Swans Came to the Lake*, and numerous contributions to *WER*) has undertaken the ambitious task of surveying the history of warriorship on Earth, from pre-historic times to the eco-warriors of Earth First!. He examines both Eastern and Western traditions, and covers the martial and spiritual, male and female, atrocities and splendid achievements in the arts of civilization that have followed from these traditions. In the process, he has gone beyond his initial task to produce no less than an interesting, concise history of the world, providing a context for the rise (and fall) of each warrior tradition, and demonstrating the raw, real roots of much of our views and behavior here in the last days of the millennium.
—Tom Hast

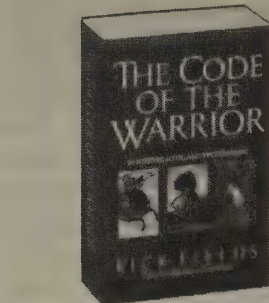
- Though the true warrior is a fighter, he or she does not fight out of aggression. The apparent fierceness of the warrior proceeds from a primary caring for others. Putting others before oneself is the ultimate source of the warrior's courage. Like the thorn on the rose, the warrior exists to protect others — the family, the clan, the nation. In the contemporary world, where the interdependence of all forms of people and of all forms of life is now clear, the warrior's loyalty and protection is beginning to extend to the earth itself.

- The Lone Ranger, who first rode the airwaves of radio station WXYZ in 1933 out of Detroit, was a composite figure, the culmination of all the mythic cowboy figures that had ridden the Great Plains in pulp novels, Wild West shows, comics, radio,



and movies. He was the most perfect embodiment of the myth of the lone warrior, a uniquely American version of the heroic warrior.

This myth of the lone warrior was derived partly from the Christian heroism of the European knights, partly from the citizen militia who fought against the tyranny of royalty and inherited privilege, and partly from the frontiersmen who fought Indians to clear the land for civilization. Its purest form was the cowboy savior. The myth of the lone warrior is recent, as far as myths go, and seemingly marginal, arising as it did not in any of the great centers of world



The Code of the Warrior (In History, Myth, and Everyday Life)

Rick Fields, 1991; 339 pp.

\$15 (\$17.75 postpaid) from HarperCollins Publishers/Direct Mail, P. O. Box 588, Dunmore, PA 18512; 800/331-3761 (or Whole Earth Access)

civilization, but in a remote former European colony. And yet, through American force and media technology, it has tremendous power, not just in America but in the television-linked global village.

- There are some who consider aikido to be the evolutionary culmination of the way of the warrior. Certainly a case can be made that the samurai, isolated for so many centuries on their island and relatively uncontaminated by outside invasions or influences, provide a unique chance to study the evolution of the warrior. Japan, we might say, is the Galapagos of the warrior.

Aikido and the New Warrior

Is it possible to defend oneself from attack and still practice nonviolence? A man named Ueshiba, earlier in this century, created (he would have said "discovered") an impressive answer to this question, a set of practices known as Aikido.

If you have trained in karate, your trained reflexive response to hostile physical movement is to block and counterpunch, to defend yourself by breaking anything that tries to break you. In Judo, your trained reflexive response is to throw the attacker, using the attacker's own momentum, and your knowledge of bodily leverage; after a few elegant slams against the wall and floor, attackers tend to give up. In Aikido, the automatic response is to blend with the attacker's moves, to move into a position that shows you the world from the attacker's point of view, before redirecting your attacker's physical energy in a way that minimizes harm to everybody.

In Aikido, you learn to instruct those who attack you, and thus take responsibility for the attacker's well-being as well as your own.

Aikido is known to most people as a martial art, but those who practice it know that the martial part is a side effect. Yes, when you get good at Aikido you can protect yourself better. But you protect yourself better not because you know secret pressure points, or develop callused hands, but because you have trained yourself to pay attention to the way the universe works. You don't have to be a religious believer, but everybody who studies Aikido for any time realizes that it is a way of being in the world, with the world, with yourself, and with other people. Self-defense is just one of many benefits of systematically trained attention to the world.

You can't learn Aikido by reading about it, but you can learn about it, especially if you read the right authors. Richard

Age of Propaganda

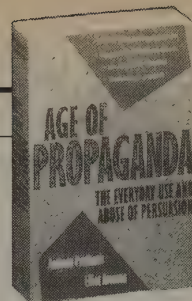
In an age in which the average American watches almost 40,000 commercials a year and in which political debate is more soundbite than substance, we certainly need to know more about the facts that govern persuasive appeals. Social psychologists Pratkanis and Aronson have successfully translated sixty years of scientific research on persuasion into a text that is readable, entertaining, and sometimes alarming. The book looks at the general factors that determine when we will be persuaded by a message, then presents an in-depth discussion of currently popular propaganda techniques. Along the way the authors document how knowledge of the techniques being used can moderate the effects of a persuasive message, and provide hints as to how readers can defend themselves from undue influence attacks. —Michael Smith

• War causes a great deal of harm and destruction, often to innocent bystanders and children. The cognition "I and my country are decent, fair, and reasonable" is dissonant with the cognition "I and my country have hurt innocent people." If the harm is clear, then you cannot reduce your dissonance by claiming that it wasn't done or it wasn't really violence. In this situation, the most effective way to reduce dissonance is to

minimize the humanity or maximize the culpability of the victim of your action — to convince yourself the victims deserved what they got.

How else can we account for the following phenomenon? Near the end of World War II, American planes dropped nuclear bombs on Hiroshima and Nagasaki. More than 100,000 civilians (including women and children) were killed, and countless thousands suffered severe injuries. It is currently fashionable for most Americans to decry that decision. But a week after the bombs were dropped, a public opinion poll indicated that less than 5% of the American population felt we should not have used those weapons, and an astonishing 23% felt we should have used many more of them before allowing Japan the opportunity to surrender.

• Opinion pollsters have long known that subtle changes in the wording of a question can produce dramatically different responses. For example, the percentage of Americans supporting aid for the Contras in Nicaragua from 1983 to 1986 varied from 13% to 42%, depending on how the question was worded. If the question mentioned Ronald Reagan or the Contras explicitly, or used ideological labels to identify the opposing forces in Nicaragua, more Americans supported the aid. If the question mentioned a dollar amount of aid or presented both sides of the issue, fewer Americans wanted to give aid to the Contra rebels. Legitimate pollsters who

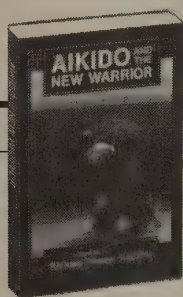
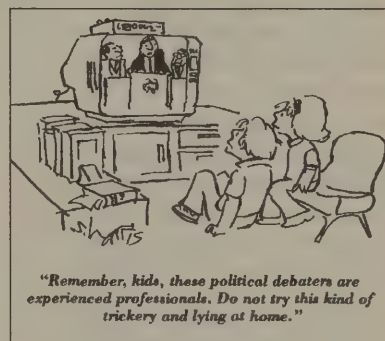


Age of Propaganda

(The Everyday Use and Abuse of Persuasion)
Anthony Pratkanis and Elliot Aronson,
1991; 299 pp.

\$11.95 (\$14.95 postpaid) from W. H. Freeman and Co., 4419 W. 1980 S., Salt Lake City, UT 84104; 800/488-5233

seek accurate responses will go to great lengths to avoid bias in the wording of questions. Those who seek to use polls for their own advantages — to convince people that everyone else supports their policy or their political candidacy — will not be so careful.



Aikido and the New Warrior

Richard Strozzi Heckler, Editor.
1985; 230 pp.

\$12.95 (\$15.45 postpaid) from North Atlantic Books, 2800 Woolsey Street, Berkeley, CA 94705 (or Whole Earth Access)

Strozzi Heckler, editor of this volume, knows what he's talking about. I've taken the mat with him at his Dojo enough times to experience what he means. He's taught Green Berets and elementary-school children. I like his way with words as much as his ki — that ineffable but undeniable energy that flows through an Aikido master's every move. His other authors include equally articu-

late practitioners like George Leonard and Morihei Ueshiba, the founder of Aikido.

If you want to do something with your body, mind, and spirit, and the idea of a martial art that is also a "way of reconciling the world" intrigues you, pick up this book before you go to a Dojo to see a master and students in action. —Howard Rheingold

• Through blending with a confrontative situation one learns to resolve the confrontation without being a loser, on the one hand, or hurting someone, on the other. The principle reveals itself through countless Aikido techniques and enables these youth to replace their conditioned reflexes with a more responsible and appropriate response.

As they learn Aikido, the fundamental thing that begins to happen to these young people is that their ability to feel and sense is awakened. When they allow themselves

to feel, they are often terrified by the rush of sensations, streamings, and emotions that come with feeling. But as they learn to be with feelings from a centered and grounded place, they find a new sense of power and ease. They embody power instead of imitating it. To feel and experience life rather than pretend or fantasize about it is a fundamental principle of Aikido. It is a first step in throwing off the dictator within. This path of self-discovery emphasizes the importance of executing each technique with the proper spirit or energy. The kids quickly learn that Aikido is not necessarily a collection of techniques to perform on someone, but a presence of being that can both be practiced in the Aikido classes and lived in daily life. This presence is an attitude that includes a priority of self-responsibility — perceiving conflict and pressure as actual opportunities in which to grow and discover oneself, blending with situations as an alternative to fighting or running, and trusting their own feeling and intuitive dimension.

—Richard Strozzi Heckler

Will The Military Miss The Market?

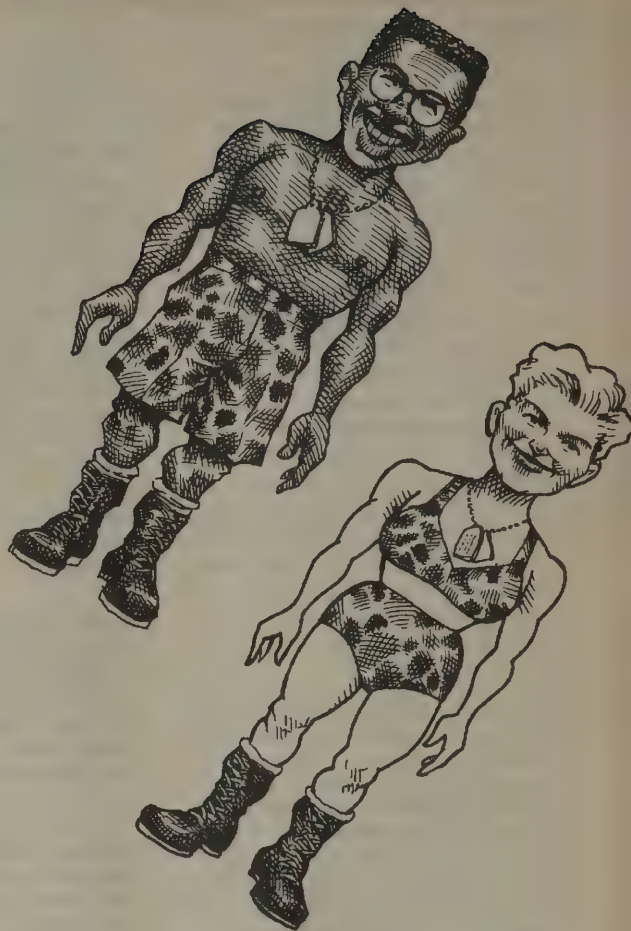
BY JOHN L. PETERSEN

Here's a new wrinkle on the widespread discussion of ways to transform the US military, redefine national security, and turn our attention as a nation to the environmental and educational crises. The interesting part is that it wasn't written by a limo liberal or a Berkeley leftist, but by a former naval flight officer and decorated veteran of the Vietnam and Persian Gulf wars. John Petersen, president and founder of The Arlington Institute in Arlington, VA, has worked and studied at the National War College, the Naval War College, the Institute for National Security Studies, the Office of the Secretary of Defense, and on the National Security Council staff.

The Arlington Institute is the only institution I have ever encountered that includes William Colby (former Director of Central Intelligence), Amory B. Lovins (NER-beloved soft-energy-path guru), Peter Schwartz (futurist colleague of Stewart Brand), and Elmo Zumwalt (former Chief of Naval Operations) on its Advisory Committee. Strange bedfellows, a strange place for radical ideas to emerge, but these are strange times. I met Petersen at the Eco-Tech conference in Monterey, one of those gatherings that bring together people who might not ordinarily meet.

Petersen can be reached via email at arlinst@igc.org.

—Howard Rheingold



THE STORY OF how Detroit arrogantly discounted indications of change in the attitudes and values of the American car buyer is well known. The American automobile industry missed a major market shift. In the face of clear indications of changing perceived needs by American purchasers, auto executives took the position that: "We do big cars, and the American people want big cars." They would sell a different style or color, but size (and resulting poor fuel economy) was sacrosanct. The customers changed their minds.

Those early decisions — and later ones centered on quality — caused Detroit to miss the shift, and what was effectively a 100-percent market share has fallen to 60 percent, with the difference taken over by foreign manufacturers who were listening to the customer. If our auto industry is not dying, clearly it is in poor health.

The same strain of virus is afoot in this country again, but this time its victim may be the military. The fundamental concept of national security is changing — the market is shifting — but our armed services are not yet responding to this fundamental change. They still want to do business much as they have in the past.



ILLUSTRATIONS BY MATT WUERKER

The Military Doesn't Know Its Customer

The armed services' problem comes in part from the fact that they don't know who their customer is. The situation is not as simple as it is for Procter & Gamble or Sony, who unambiguously sell their wares to individuals whose psychographics they can monitor. The Pentagon must be responsive to the Congress as well as to the Administration (not at all easy); and then there are the defense contractors, the retired-service-member community, and other groups with influence. In a real way, the ongoing necessity to match service policies with the moving target of official Washington causes the military to lose the perspective that they work for the American people.

Don't misunderstand. Military officers

certainly know that they serve the American people, but on a day-to-day basis they must deal with the vicissitudes of the people's representatives, and in so doing they forget that it is the people who vote, and everyone else, Administration and Congress, ultimately responds to that message. The American people are the retail market for the military, and they are ignored at great risk.

Because of their relatively insular international/Washington orientation, military professionals don't generally understand the American "domestic" market. They don't deal with the country's health-care problems, because they provide their own medical services. It is illegal for them to participate in politics. The major problems of our urban centers are remote. The country's physical infrastructure de-

cay is a problem dealt with by contractors.

The far-flung armed-forces fraternity, with members in every military town, makes it palatable for some career officers and their families to move as many as 25 times in 30 years. Because there are not many relationships with the larger community, the relative importance of the country's domestic problems often escapes them. They have a different job to do and they do it well.

A Shift in the Notion of National Security

The people of the United States are at the beginning of an attitudinal shift that is accelerating. If the military doesn't take notice and consider the implications of the change, their significance to our national security could markedly decrease.

While, in the past, security and defense were often synonymous, now defense is only one element in an expanding equation. Most Americans now believe that economic security is equal to national security. They also worry about the environment, and they are beginning to be aware of the potential byproducts of the world's exponential growth in population. They know intuitively that the poor developing countries cannot increase their wellbeing the same way the industrialized nations did without threatening the world's environmental health. They sense the complexity and interdependency of the global system and know that attempts to deal singly with problems often produce and exacerbate unanticipated others. Although they may not understand the details, they see the end result and how it affects their lives.

It is not enough that the number of security issues is growing; they are also all interconnected — not only at the local and regional level, but on a global basis. Driven in part by an information technology explosion, we find ourselves operating as part of a global system that is evolving very rapidly into a form that is not at all familiar.

A harbinger of the future importance

of environmental issues might be indicated by a recent Worldwatch Institute report. It suggests that the human inhabitants of the world have but a decade to change, in fundamental ways, their negative influence on the natural environment before present trends produce a long decline into economic and social ruin. Report director Lester Brown said in a *New York Times* interview that if the world does not respond to environmental degradation, it will lead to economic distress that is politically unmanageable. He said a look at many archaeological sites provided hints of what might come. "North Africa was once the granary of the Roman Empire. Now it's largely desert." Two weeks earlier, the Florida Institute of Oceanography had reported finding, in a five-year study, that the Florida Keys coral reef could be doomed by the year 2000 because of pollution and other human-oriented causes.

Notwithstanding these new global problems, Americans now believe that the most pressing security threats to this country are internal rather than external. At home, America's streets and bridges, schools, environment, cities, health care system and economy are in trouble, and the American people know it. Former Commandant of the Marine Corps General Alfred Gray has said, "The greatest threat to US national security is the combination of crime, drugs, lost educational opportunities, and the economic consequences of these failures."

The recession has crystallized these concerns and is producing new levels of anxiety and lost hope. Pollster Daniel Yankelovich, commenting for *Fortune* magazine, recently said about the recession, "People's jobs and homes are their main bastions of economic security, and the idea that both would be at risk is frightening, particularly for the generation that's younger than mine. Now they're getting a double whammy. Instead of the value of their homes going up, it's going down. Their debt becomes a nightmare. Then everyone knows someone who has lost his job. In restructurings the people who are laid off won't be laid back on again. The combination is an awfully big dose of reality.

"That leads to a moral significance. By putting the spouse to work, borrowing money, and piling up government debt during the 1980s, we were masking the reality that we were not doing better," Yankelovich said. "This time people don't have any real belief that things are going to get better. After failing to persuade them that no action was required, the political leaders are finally acknowledging the problem. But they haven't made a credible case that they have a course of action." He added, "What's panicking people is not the present but the future."

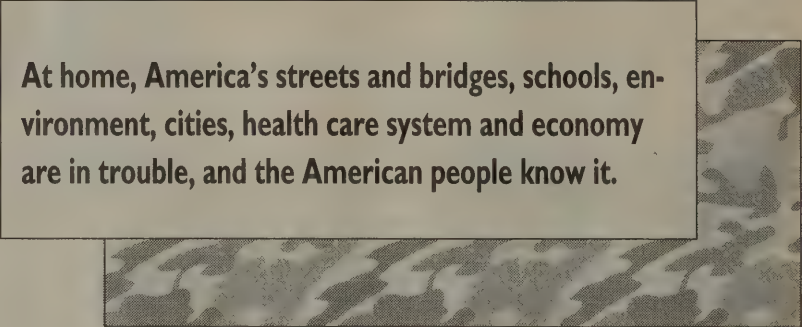
The most pointed example of this feeling is found in the "America First" sentiment and its own presidential candidate, both of which reflect frustrations with the way the country is not working (but discount the equally important interdependency we share with the rest of the world.)

Unless a high-profile conflict or enemy arises that requires American troops, sensitivity to these problems will only increase. The erosion at home has put in place coming events that are prede-

debt will sap even larger percentages of our country's ability to deal with these problems. If present trends continue, interest payments on the national debt will overtake discretionary domestic spending this fiscal year, and expenditures for defense in about three or four years.

These new problems are national security threats, as much as (or more than) Saddam Hussein or Libya's Quaddafi.

For the first time in most Americans' lives, the new, turbulent reality has forced traditional defense concerns to share the security platform with unfamiliar but equally valid and vocal advocates. As *U.S. News & World Report* writers Bruce Auster and Robin Knight have put it, "After two world wars, 45 years of nuclear confrontation and billions of dollars, pounds, rubles and francs invested in manpower and weaponry, military power suddenly has ceased to be the dominant measure of a nation's strength, or even the best guarantor of its security." Defense is being squeezed into the wings, out of the limelight.



At home, America's streets and bridges, schools, environment, cities, health care system and economy are in trouble, and the American people know it.

termined... and largely negative. Sewer and bridge failures will become more common. Engineers and technologists that we need to compete in the information age will not be available. Fourth- and fifth-generation underclass families will live in inner-city neighborhoods that begin to remind one of the movie *Blade Runner*. More city and state governments will face bankruptcy, along with financial institutions. Pressure from the uninsured poor (and the states, which have to care for them) are forcing a reassessment of our health care system. Payment on the national

The military is profoundly aware of the net effect of this trend: a quarter of its budget is evaporating. But generals and admirals largely impute this new austerity to the implosion of the Soviet Union and communism; the other, more fundamental driving forces of the underlying shift are not apparent. In part, they are misled by history, because this shift is not a variation on the past. The new era is orienting itself in a way that is quite different from the memory of anyone now alive. The end of WWII produced major defense cuts driven by the assumption that there were no more

If the military is going to continue to own the major share of the national security business, it will have to follow the market shift and go where the new problems are.

meaningful threats. After Korea, the external foreign communist threat persisted. But now the enemy is not without, but within, and if we look to the past for direction and meaning we will be misguided. We must look to the future. Our security threats are not just decreasing — they are shifting.

Americans Adjust Rapidly to Shifts

Brand loyalty does not run deeply for most Americans. If the product they have been buying isn't meeting their needs, they will change brands or move to another product — just ask GM. Americans treat the US budget like their discretionary income— which it is. When important aspects of the country's security are not being served by the military, they will spend their money elsewhere. Just ask George Bush why he wants to take more money from defense and spend it in the domestic arena. Election-year scheming aside, if the American people had not already begun to discount the military, the president would never have proposed another cut in defense.

Along with their funding, the utility and relevance of the armed forces — in greater degree than they have imagined — are also being reassessed. As the new concept of national security evolves, the question will increasingly be, "What is the military doing to help us deal with our (new) security problems?" If the armed forces' answers appear to be tangential, their influence and stature will surely wane.

This is an issue of perception — not necessarily one of reality. As we will see, virulent external threats still per-

sist. But our budget decisions are based upon the feelings of the people; and right now, above all else, the real threats appear to be at home.

Acting on Feelings Alone Can Be Dangerous

When the communist flagship went under, it became obvious that the US didn't need as large a military as it had. Plans were made to decrease all of the services substantially — 25 percent over five years. For much of the last two years (with time out for Desert Storm), the Pentagon has been consumed with designing and planning for the cuts. But, missing the significance of the American attitude shift, they have (like their car-maker brethren) proposed only doing variations (mostly less) of the same thing that they have been doing for the past four decades; no major changes in roles. Parts of the strategic nuclear force will drop from the product line or be reorganized, but in the end, essentially only fewer airplanes, tanks and ships will be offered up.

If the military continues to be seen in only "armed forces" terms, Americans, through their elected officials, will act decisively: they will cut the annual defense budget much more deeply — perhaps to 50 percent of previous levels, about \$150 billion. At 25 percent, the services are reeling. At 50 percent they will feel annihilated.

There is a good news/bad news aspect to this coming train crash. The bad news is that if our services continue to respond as they have, the cuts will come so fast that there will be little time for effective contemplation and plan-

ning. Savings will be grabbed wherever they can be, with little relationship to the powerful forces driving the change. Negative synergy will disembowel the services, yielding hollow, unready, overextended forces. We know that's what will happen: it has happened every time in the past. After World War II, ships spent part of every day at sea dead in the water for lack of fuel. Boilertenders rotated up to man the guns because too many gunner's mates had been let go. Airplanes didn't fly and crews weren't trained.

In their hurry to unload the military, Americans may well miss the fact that future external threats may be worse than in the past. In a lucid and much-needed speech, Congressman Les Aspin, chairman of the House Armed Services Committee, recently outlined his assessment of the major new military threat that confronts the US: nondeterrable terrorists armed with nukes. This looming problem will require serious resolve and new kinds of military capabilities. A very plausible scenario involves one of our major cities (New York would be a likely target) being threatened by a terrorist organization armed with a nuclear weapon.

Former Soviet Foreign Minister Eduard Shevardnadze was reported in the *Boston Globe* to have said that he would be "terrorized" at the prospect of what could occur in the disbanded Soviet Union. The *Globe* suggested that an estimated 2,000 tactical nuclear weapons are deployed outside the four nuclear states of the commonwealth. Another is that 50,000 tons of chemical munitions are dispersed across the lapsed union — toxic substances suited for bombs, missiles, rockets and mortars, and easily hidden. Some reports suggest that political leaders of the new republics have already given in to the temptation to convert "just a couple" of their warheads into hard cash.

In the face of pressing internal threats, shortsighted Americans are likely to lose interest in the gauzy problem of potential terrorism (after all, we've never had any significant terrorism here) and eliminate war-fighting capability that we may desperately need in



the future . . . or call back forward-positioned forces, setting up a far worse situation that may ultimately require much greater military action.

East Asia is a clear case of the latter. Almost every country in the area, Japan included, believes that American Pacific forces are the major guarantor of regional stability. Old, Balkan-style animosities simmer under a pacific façade — held in check by the regular presence of the US military.

If, for budget reasons (or a change in relationship with Japan), the US pulled back to Hawaii or the West Coast, most Pacific Rim thinkers believe that Japan would be obliged to begin a substantial arms buildup so as to be able to protect its lifeblood — the ability to import the many commodities on which the country depends. The way the relationship is going now, it would be understandable if Japan didn't place much confidence in our assurances that we would come to their rescue in the event of a serious problem. Other East Asian nations promise that in the face of such a

buildup, they too, remembering WWII, would do the same. Without the ameliorating role of the US, any number of destabilizing regional conflicts might ensue.

The good news is that extraordinary opportunity attends such massive change. However the military acts, the decisions of the next two to three years will almost certainly cast in concrete many of the capabilities that it will possess for decades to come. With all of the traditional rules off and everything up for grabs, perspicacious leaders can take advantage of the situation to put in place new structures and establish new roles that send our military in a direction aligned with the future rather than the past.

Reposition and/or Expand the Product Line

Anyone familiar with the consumer market knows there are two things that can be done to deal with a market shift: reposition and/or change the product

line. Just last spring, GM chairman Robert Stempel reportedly rejected board members' suggestions that the company cut executive salaries and drop money-losing Oldsmobile from the product line. The finally adopted plan was characterized by some analysts as "Draconian, [but] mainly continued past policy." Merely less of the same thing.

The military must not make the same mistake. The whole spectrum of the new security market must be addressed. At all costs, we must protect the capability to defend ourselves with force, particularly against the nuclear terrorist threat that confronts us. At the same time, though, energy must be directed into these new security-threat areas.

To make a safe adaptation to the new market, two things need to happen:

- The attitudes of the American people must be anticipated, understood, and believed.

If the military is to provide the best service to this country over the next decades, it must understand how Americans' attitudes are evolving and what the implications of that change might be. A number of well-known survey research firms track these trends. Analysis of historical value and trend shifts in specific social segments should be acquired and distributed and made a common component of all planning by the services.

- Better images and ideas must be developed of the country's broadest future security requirements.

Scientific, technological, population, environmental, and weapons-proliferation trends will continue to foment turbulence and uncertainty. The rates of change of these forces suggest that we might not recognize the world of 30 years from now if we could glimpse it today.

Turbulence calls for foresight — the ability to begin to anticipate what might be on our horizon. Methodologies coming out of the business community now make it possible, using new broad scenario-design techniques, to begin to understand the possible and plausible behavior of a domain like national security with much more confidence than

in the past. A systematic, regularly updated process needs to be established within the military hierarchy to illuminate unanticipated future options and problem areas.

A better knowledge of Americans' attitudes, coupled with a new understanding of the emerging security environment, would provide a resilient underpinning for pursuing new ways to reposition and/or expand the military "product line."

Present missions and activities should be analyzed in light of the new set of security concerns, and repositioned accordingly.

We should have a proactive, preventive component to our strategy of dealing with the nuclear-terrorist and global-development problems. The increasing disparity between the haves and have-nots is a breeding ground for those external threats, and it is critical that we confront the problems at their sources. As Alexander King and Bertrand Schneider have written in *The First Global Revolution*, "Reductions in economic disparity and aid to development of a wise and cooperative character, far from being a humanitarian gesture, is of fundamental self-interest to the rich countries." New models of economic development and nation-building would allow our military to contribute directly to these issues. Developing nations present real opportunities, both to realistically train and to make a contribution to this larger external problem.

The armed services have the organic capability, in both active and reserve forces, to establish the basic infrastructure required to efficiently support large numbers of people in primitive areas. They can build roads, buildings, food and sanitation systems, communication systems (phones, radio stations, TV stations), railroads, seaports, airports, and aviation control systems. They can drill wells and irrigate, establish police and fire departments and supply and distribution systems.

The problem is that they usually don't get the opportunity to exercise their equipment and evaluate its effectiveness in peacetime. These skills are best

honed by actually working in the type of context that might be confronted in war. Many countries desperately need the kind of help I've mentioned above. Their ability to become productive contributors in the global marketplace is hampered by a lack of physical infrastructure. Our military could play an extraordinary role in helping some nations in this way.

Some training required for combat readiness could also be the product of other activities. Already our military provides badly needed medical and engineering construction help in some developing countries, while Army physicians work in emergency rooms of inner-city hospitals — where they can practice repairing gunshot wounds.

We could lend a hand with bandit and pirate problems, develop customs and border-control processes, establish civil aviation systems and search-and-rescue procedures — all from internal military skills. A survey of the broad environmental state of the Amazon basin would be meaningful flying practice for an Air Force aircrew. Navy and Air Force units could help set up control and patrolling procedures for waterways and littoral areas.

These ideas are not new (in isolated cases some are already being tried); they just need to be revisited. Marine Corps combined-action platoons, for instance, demonstrated during the Vietnam War that military personnel can be very effective in nation-building assignments even under the worst of conditions.

With the military's humanitarian successes in helping the Kurds in Iraq, the flood victims in Bangladesh, the volcano refugees in the Philippines and the Haitian refugees in Cuba, disaster relief has become a de facto mission for our military. We should formalize and institutionalize this capability, and perhaps offer to work directly with the United Nations on such projects.

The benefit to our soldiers, sailors and airmen would, in every case, be good training, and would provide the extremely important experience of working cross-culturally (which is always needed and often not available in con-

flict situations). In the past, many countries have asked US military commanders to provide nation-building services, but most have had to be turned down because of American regulatory constraints — not for other potential problems.

Develop a New Set of Roles and Missions

If the military is going to continue to own the major share of the national security business, it will have to follow the market shift and go where the new problems are.

The nuclear-terrorism issue must be addressed head-on. If we plan and implement now, we can put in place capabilities that may well prevent future disaster. If we wait too long, we may not have time to react. Information is the best defense against terrorism. Information-gathering systems and processes should be upgraded and more highly prioritized. Traditional military capabilities need to give way to specialized capabilities that can identify and negate threats before they make it to our shores.

Internally, there's not much the military can do about the failure of our educational system or the health of the economy. But things like toxic-waste cleanup and infrastructure repair offer more promise. For example, retired Army general Frederic Brown advocates, in an upcoming book, fielding specially trained "Chernobyl battalions" that would be able to deal with nuclear and other toxic disasters. These units could train in our own back yard by helping to clean up some of our notorious nuclear-weapons plants.

The collapse of the social structure of many of our inner cities — one of the biggest problems we have — offers the most opportunity for the military's skills. Urban centers are the most important components of our economic system, and they are sick. If we are not successful in finding new, much more effective ways of dealing with our inner-city problems, we risk having them consume us. Generations of young people are not only being lost to society, but are trying to destroy it.

George Will, writing about UCLA professor James Q. Wilson's new book, *On Character*, says Wilson's definition of good character includes two qualities — empathy, meaning regard for the needs, rights and feelings of others, and self-control, meaning the ability to act with reference to the more distant consequences of current behavior. Who in our society does a better job at training, educating, and developing leadership and character in young people than the military? It is the great resource the military gives this country: highly qualified and motivated young people who are willing to work long hours in situations fraught with personal risk. One only needs to remember the images of our men and women in Desert Storm, watch the 21-year-old (average age) crew operate an aircraft carrier or observe a foot-slogging soldier trudging on miles past exhaustion to know that no other institutions come close to building quality in people like our services do. Those very skills are at the core of the problems that our inner-city communities face, and no one else has the capacity of the military to make profound change.

This is not just speculation; for over a decade there have been over 100 successful programs scattered around the country that use the military infrastructure to help urban kids. These are not "shock" boot camps (of the kind now run by most states), but programs running the gamut from tutoring to rigorous, multifaceted programs that systematically focus on establishing self-discipline and team building, self-

confidence, skill training, work experience in new settings and, finally, community reintegration and career development.

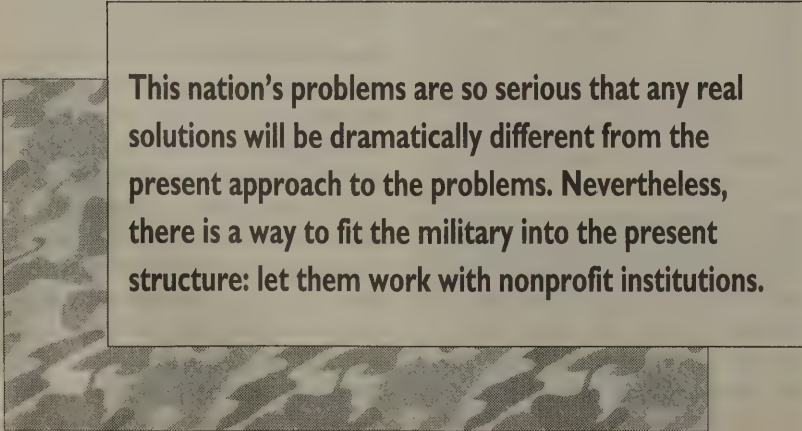
Memphis, Tennessee, has programs that can take a youngster step by step from the courtroom to the factory floor. Offenders who are offered the choice can enter a three-month "Project 1990s — Save America's Youth" program, described by *Insight* magazine as "basic training without combat as the goal." Participants are made a part of a ten- to twelve-person team that is directed by former Marine drill instructors. The DIs take care of the physical training and other "troop handling" and team-building responsibilities, moving the groups between classes taught by trained instructors. Schoolroom training may include emphasis on literacy, remedial academics, substance-abuse education and treatment, and family counseling. Intensive medical, psychiatric, psychological, substance-abuse, academic, and vocational assessment is central to the program. Instructors are likely to be retired or volunteer military members.

Youth Service USA, headed by Episcopalian priest Father Don Mowery, can take over from Project 1990s and provide job skills training and employment placement for 18- to 24-year-olds. After surveying potential employers to determine skills needed in the area, they put inner-city youths through an occupational-training program held on a military base and in government offices. Military trainers teach virtually every type of vocational skill through

competence-based, structured curricula. At the same time they provide classroom training in employability skills such as work habits, employer expectations, and job interviewing. The program places 80 percent of its graduates in jobs.

Retired Marine officer William Holmberg has approached the Marine Corps with a proposal to use marines and the Marine Corps base at Quantico, Virginia, to work with youthful offenders from Washington, DC. Holmberg's "Green Team" would teach youngsters the basic skills needed to compete in the larger world while having them work on ecology/environmental projects on the Quantico base. Activities would revolve around special projects, like: vitalizing a specified number of acres through selective clearing, repairing, mineralizing, and planting with correct species; harvesting, chipping, and arranging for transport of the bio-fuel recovered from their assigned acreage; working with other teams to compost fly ash and limestone sludge from nearby power plants and wastewater treatment plants; studying, protecting, and restoring a specific reach of the Potomac River or a section of wetlands; cooperating with other teams in preparing the land, planting, harvesting the crops and again preparing the land for high-density and scientifically advanced organic farms and gardens; and rehabilitating rooms similar to those found in public housing.

Between 1968 and 1972, the Department of Defense had a Domestic Action Council. The council's mission was to determine actions that could be taken by the Department of Defense to help resolve pressing domestic problems without degradation of military preparedness. The DDAC should be reestablished to provide direction for the military's efforts in this new security area and to keep pace with the "new market" being defined by the ongoing paradigm shift. A companion Joint Domestic Support Command would be staffed primarily by military personnel to support local and state governments in resolving certain pressing urban problems. An additional mission would be to coordinate the activities of federal departments and agen-



This nation's problems are so serious that any real solutions will be dramatically different from the present approach to the problems. Nevertheless, there is a way to fit the military into the present structure: let them work with nonprofit institutions.

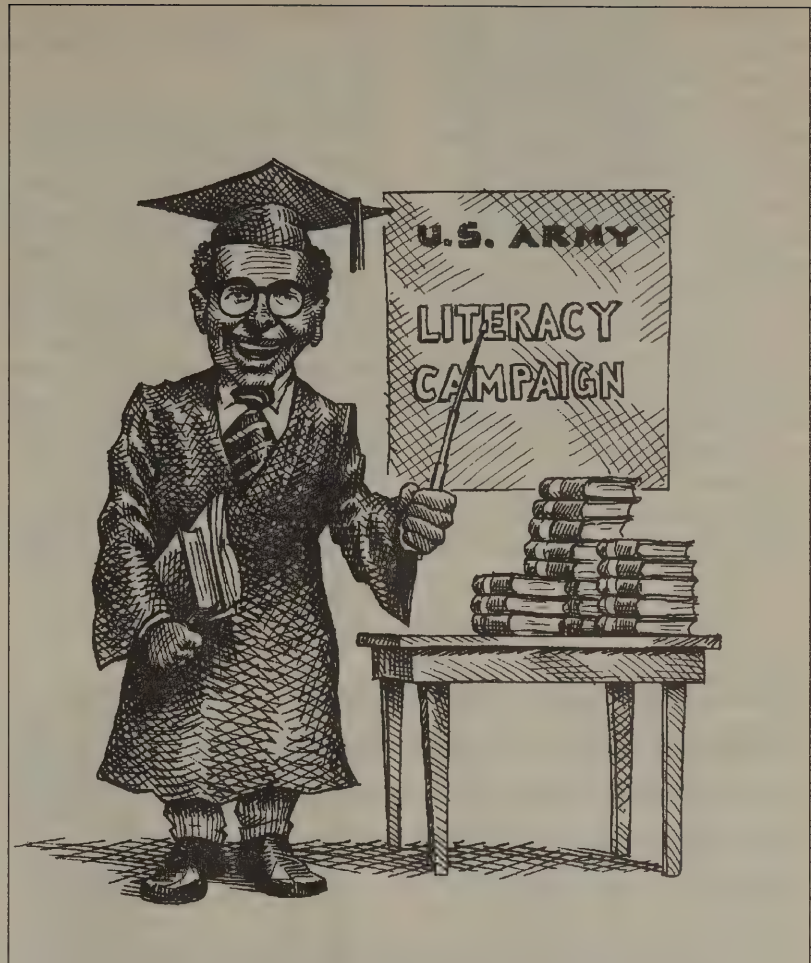
cies and marshal resources to support local governments in addressing these problems.

Some might worry about the "militarization" of our inner cities or of our armed services "competing" with commercial concerns. Old standards are not operative any more. This nation's problems are so serious that any real solutions will be dramatically different from the present approach to the problems. That is a given; the present methods aren't working. Nevertheless, there is a way to fit the military into the present structure: let them work with nonprofit institutions.

Peter Drucker wrote recently in the *Wall Street Journal* that virtually every success we have scored at solving the country's social problems has been achieved by nonprofits. He mentions that "Two-thirds of the first offenders paroled in Florida into the custody of the Salvation Army are 'permanently' rehabilitated — they are not indicted for another crime for at least six years. Were they to go to prison, two-thirds would become habitual criminals. Yet a prisoner costs at least twice as much per year as a parolee in the custody of the Salvation Army." Drucker says a well-managed nonprofit gets at least twice the bang out of each buck that a government agency does. He advocates "nonprofitization" as modern societies' way out of mismanagement by welfare bureaucracies. Military skills and resources coupled with nonprofit management savvy could go far in dealing with our internal deterioration.

Another major resource associated with our military is the government research laboratories. Most of the 70 national labs are being affected by the market shift in the same way as the military. Some of the major ones are actively discussing getting into new businesses, now that building nuclear (and some other) weapons is not a growth industry. Los Alamos National Laboratory, for example, recently sponsored a major conference on technology and the environment, hosting some of the foremost thinkers in the world on the subject.

But much more could be done. Our labs could look into desalinization of



seawater using solar power, since the availability of fresh water could well be the source of the next war in the Middle East. New closed systems are technologically feasible that could produce energy as well as a significant amount of fresh water. Novel approaches of this kind are needed in the developing world to bypass the waste and pollution products that attend(ed) the development of countries like ours. If our research labs seriously believed that environmental, energy, and waste-disposal problems were national security issues, they could bring many times more effort to bear on them than private institutions have been able to in the past. Even half (even a quarter) of their \$12 billion-per-year budget spent on these new threat areas would make a tremendous difference.

Our labs should think about linking up with the Russians to attack these problems. The *New York Times* reported that Dr. Yuri A. Trutnev, the physicist who

runs the day-to-day activities of the main nuclear-weapons lab of the former Soviet Union, suggested shifting the lab's nuclear work toward peaceful ends. He was in the country trying to drum up joint projects with our national laboratories. "The genie is out of the bottle," he said in an interview last month. "Let's use it for the benefit of mankind."

Not All New Ideas

These ideas are not as radical as they may sound. The senior leaders of the Department of Defense are aware of the implications of change and have identified some of the opportunities that are available. Defense secretary Dick Cheney knows, from being a congressman and White House Chief of Staff, how the legislative body will react to the shifting sands of public opinion. Admiral David Jeremiah, Vice Chairman of the Joint Chiefs of Staff,

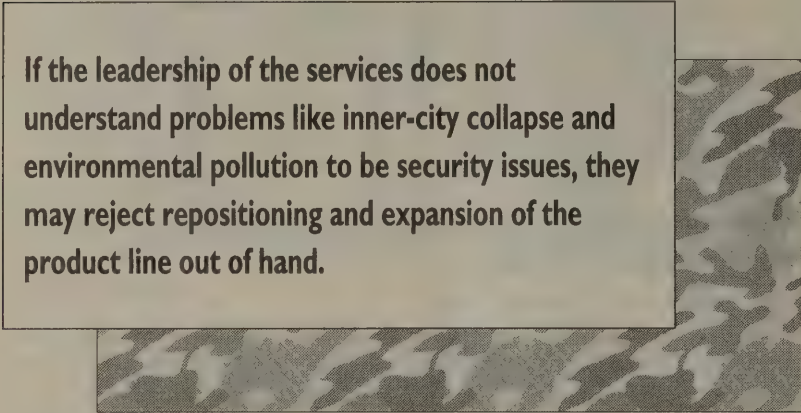
was quoted recently in *Navy Times* as saying, "For the first time in 50 years we have a chance to reform the Department of Defense. Nobody else has been able to do that. We've been locked into this East-West conflict.

"Think about the fact that the population of the world will double to about 10 billion people by 2025," Jeremiah said. He further mentioned that about 90 percent of the world's population will live in underdeveloped nations and about 25 percent will be hungry most of the time. Ten or 15 percent of the world's population will be well taken care of; the rest will be disadvantaged. "You'll see competition for resources, not just oil, but increasingly,

Conservation Corps, but have been getting a cold shoulder from within the organizations.

Although Cheney and Jeremiah may be reading the tea leaves much better than most, their ability to influence the services is, in important ways, limited. The Defense Department is a huge, unwieldy organization with mixed allegiances. Those close to the heads of power regularly make the point that no one really dictates to the services what they will do. Directives that are not agreed with can be rather easily buried, or implemented very slowly.

Therein lies the problem. If the leadership of the services does not under-



If the leadership of the services does not understand problems like inner-city collapse and environmental pollution to be security issues, they may reject repositioning and expansion of the product line out of hand.

with that kind of population, you are going to see competition for things as simple as fresh water," he said. "You would like to deal with this on a political and social level." The military's role should be subtle, similar to the role it now plays in Central and South America — digging wells, building roads, and teaching the militaries of host nations how to operate under a democratic system, he suggested. He went on to propose that Operation Provide Comfort, the giant US military rescue mission to save Kurdish refugees, might have been "a precursor of what we can look forward to in the next decade if not the next century."

Individual senior defense executives have been bold enough to propose using military master teachers to help in our troubled educational system and setting up a version of the old Civilian

stand problems like inner-city collapse and environmental pollution to be security issues (like the early straight-arm they gave to the drug-fighting mission), they may reject repositioning and expansion of the product line out of hand. In the case of change as profound as that being advocated here, the services must see that their very role (and importance) in our society is at stake, and understand that expending time on the turf wars, trying to get a larger share of the budget wrested away from another service, is the proverbial deck-chair rearrangement on a sinking ship.

The change that Army, Navy, Air Force, and Marine leaders would need to initiate and sell runs counter to the very essence of what, in some cases, they see as their most solemn (if unstated) obligation: to look out for the wellbeing of

their people. In the long term, that is exactly what such initiatives would do; but in the short run, this radical change would look to many in the system like an attempt to emasculate America's armed forces and destroy the essence of what they have always stood for. Service leaders should look at what's happening to the US in the world and ask themselves if it is better to be the most important actor in the most important area of government responsibility, or just one of a number of players.

America needs a strong military. It is one of the few things in which we still excel. But there is a bonus here: the military skills and character of our armed forces beget the potential to deal with some of these ominous internal threats. There's an additional benefit: how much better it would be to be known around the world for a military that both had the ability to defend and to destroy, and that could materially work to prevent situations that required the use of force. Superb fighters could be equally effective nation-builders.

The times call for leadership and vision. The decision must be made now. If the light is seen after much of its capability has been eliminated, our military will be in no position to contribute as it might have . . . and some other agency (or perhaps some company) will have acquired the business.

D. Quinn Mills of the Harvard Business School was recently quoted as saying about General Motors, "In a sense the company is liquidating itself. It's giving up market share and laying off people in an attempt to be profitable at lower market-share levels." He noted that they have been losing about 5 percent of their market share every seven years. "They will survive and sometimes be profitable for another 15 years," Mills said. "But you wonder when the board is going to think it's time to be getting out of the [North American auto] business."

The American people will have what they want, one way or the other. The question is whether the military will continue to be the most significant purveyor of security to the country, or — like GM — give up great parts of its charter to others. ☛

The Conquest of Paradise

Not so many years ago, Christopher Columbus was a national hero. Now, with the quincenarian of his landing, a different picture of Columbus is emerging. To Kirkpatrick Sale, he was rapacious, homicidal, very likely insane, the Mister Kurtz of the so-called Age of Discovery. Given the wars of genocide Cristobal Colón and his successors set in motion — more than a quarter of a mil-

lion Taino Indians had been slaughtered by 1495 — Sale's speculative, often rancorous argument has many merits. —Gregory McNamee

• It may fairly be called the birth of American anthropology.

A crude anthropology, of course, as superficial as Colón's descriptions always were



The Conquest of Paradise

(Christopher Columbus and the Columbian Legacy)

Kirkpatrick Sale, 1990; 453 pp.

\$27.50 (\$30.50 postpaid) from Random House/Order Dept., 400 Hahn Road, Westminster, MD 21157; 800/733-3000 (or Whole Earth Access)

when his interest was limited, but simple and straightforward enough, with none of the fable and fantasy that characterized many earlier (and even some later) accounts of new-found peoples. There was no pretense to objectivity, or any sense that these people might be representatives of a culture equal to, or in any way a model for, Europe's. Colón immediately presumed the inferiority of the natives, not merely because (a sure enough sign) they were naked, but because (his society could have no surer measure) they seemed so technologically backward. "It appeared to me that these people were very poor in everything," he wrote on that first day, and, worse still, "they have no iron." And they went on to prove their inferiority to the Admiral by being ignorant of even such a basic artifact of European life as a sword: "They bear no arms, nor are they acquainted with them," he wrote, "for I showed them swords and they grasped them by the blade and cut themselves through ignorance." Thus did European arms spill the first drops of native blood on the sands of the New World, accompanied not with a gasp of compassion but with a smirk of superiority.

■ This separation from the natural world, this estrangement from the realm of the wild, I think, exists in no other complex culture on earth. In its attitude to the wilderness, a heightening of its deep-seated antipathy to nature in general, European culture created a frightening distance between the human and the natural, between the deep silent rhythms of the world and the deep recurrent rhythms of the body, between the elemental eternal workings of the cosmos and the physical and psychological means of perception, by which we can come to understand it and our place within it. To have regarded the wild as sacred, as do many other cultures around the world, would have been almost inconceivable in medieval Europe — and, if conceived, as some of those called witches found out, certainly heretical and punishable by the Inquisition.

Civilian-Based Defense

If we are ever seriously to consider total, permanent disarmament, a model of defense must be developed for use against the few aberrant humans able to convince large (or small) numbers of their citizens to commit mass murder. That model will most likely be something close to the ideas outlined in this book. This "post-weapons defense system" will require putting our own lives on the line. This may be disheartening, but it happens in every brushfire war around the world, and happens to young men and women facing a military draft.

Gene Sharp assumes that conflict is inherent in the human condition and that the desire for security is appropriate and just. He pragmatically assesses "people power" as if it were more than the spontaneous outpourings of nonviolent rebelliousness that recently toppled regimes in the Philippines and Eastern Europe. As a technique, civilian-based defense has proven itself in limited ways, but never (yet) as the primary, planned response to nation-state violence. While Sharp makes no claims that civilian-based defense is foolproof, he points out that the military alternative is at least as fallible, and certainly more destructive. —David Grant

Related books and a newsletter that we have reviewed include Sharp's **National Security Through Civilian-Based Defense** (WER #51, p. 20); **The Politics of Nonviolent Action** (CQ #34, p. 27); and **Civilian-Based Defense: News & Opinion** (WER #66, p. 137). —David Buror

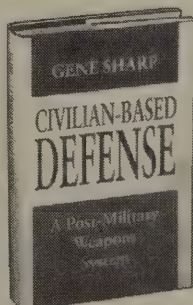
■ Coercion does not here mean submitting under threat or use of superior force. Instead, "coercion" here is the forcing or blocking of change against the opponents' will. The opponents' ability to act effectively has been taken away from them, but they still retain sufficient power to hold their positions and to capitulate to the resisters' demands. In short, "nonviolent coercion" as a mechanism of nonviolent action occurs when goals are achieved against the will of the opponents, but short of the

disintegration of the opponents' system.

Nonviolent action becomes coercive when the nonviolent resisters succeed directly or indirectly in withholding to a major degree the necessary sources of the opponents' political power: authority, human resources, skills and knowledge, intangible factors, material resources, and sanctions.

■ What methods can defenders use in order to withdraw the sources of power needed by foreign aggressors and internal usurpers? What do they need to do in the face of expected repression? A closer analysis of the technique of nonviolent action may provide some answers.

Nonviolent action is so different from milder, peaceful responses to conflict (such as conciliation and arbitration) that several writers have pointed out that it has instead significant similarities to conventional war. *Nonviolent action is a means of combat, as is war.* It involves the matching of forces and the waging of "battles," requires wise strategy and tactics, employs numerous "weapons," and demands of its "soldiers" courage, discipline, and sacrifice. Nonviolent action may understandably also be called "nonviolent struggle," especially when strong forms of this technique are employed against determined and resourceful opponents who respond with repression and other serious countermeasures.



Civilian-Based Defense

(A Post-Military Weapons System)

Gene Sharp, 1990; 166 pp.

\$27.95 (\$30.95 postpaid) from California/Princeton Fulfillment Services, 1445 Lower Ferry Road, Ewing, NJ 08618; 800/777-4726 (or Whole Earth Access)

FBI Wants Digital Snoop Power

BY BROCK N. MEEKS

Intelligence agency, plus new



THE FBI AND DEPARTMENT OF JUSTICE aren't satisfied with the level of access they currently hold when it comes to listening in on the phone calls of suspected criminals. With the advancement of digital networks, law-enforcement officials want assurances from telephone companies and telecommunications manufacturers that they will, when warranted, have easy access points into these new networks.

Current wiretap procedures are well honed; law-enforcement agencies around the world use the same technology for listening in on conversations. Because the majority of phone lines are still analog, the technology required to tap a phone line is child's play, as far as these things go. But with newer digital technologies, things become complex real quick. With voice signals mixed together and traveling on one channel, the "addresses" of the calls travel on another. Tapping into these digital rivers of ones and zeros is a technological hurdle that the FBI and Justice Department haven't yet figured out, and they want help. They're now asking Congress to provide legislation that makes it mandatory for telephone companies to give them this type of access.

In March, the FBI and Justice began floating a draft of proposed legislation that would, in their eyes, solve their problems. The proposal is "collaborative effort" at the "highest levels" involving law-enforcement officials, government agencies, telephone executives and equipment manufacturers, according to John Collingwood of the FBI's Office for Legislative Affairs.

The first draft was seriously flawed. It sought to give the FCC authorization to grant telephone companies rate increases to defray the cost of reengineering the network to bring it

into compliance. But those issues so inflamed Congress, and the telecommunications community at large, that the bill's first draft was quickly scrapped.

The new version addresses the proposal's most controversial issues: Establishing the FCC as a standard-setting body and enforcer of eventual legislation, and putting the burden of the cost for changes in the telephone network on ratepayers. The proposal now would make the attorney general's office responsible for enforcement; the FCC would no longer have the authority to allow telephone companies to pass any network modification costs on to ratepayers.

Sources in Congress say moving enforcement from the FCC to the attorney general is "no big surprise." However, the issue of costs was confusing, one aide said: the previous proposal used "magic words in the utility law" that meant costs could be recovered through the rate base. An official from one Regional Bell Operating Company (RBOC) said that removing ratepayers from the legislation would "amount to nothing," because telephone companies could still make "good arguments to the PUCs" that the expense of changing networks to comply with government edicts was mandated and could "rightly be passed on to the ratepayer."

Another Hill source said there were

only three choices for cost reimbursement: ratepayer, shareholder or government. "I don't see much difference between the ratepayer and the taxpayer," he said. "Pretty much anyone that has a phone is a taxpayer." Telling phone companies that their shareholders would have to eat the cost of government-required changes "is only going to give the phone companies more ammunition" to fight the new proposal.

The new version of the wiretap bill comes at a critical juncture for the FBI and Justice Department, which have taken flack for floating the structurally flawed first draft. The FBI and Justice, in the second technical session held in FBI offices at Quantico on April 22, expressed a desire to "keep the volume on the issue" turned down and out of public debate, according to one attendee. The attorney general's office is concerned with public debate highlighting "all that the FBI can't do," said another source who attended the meeting.

The FBI wants to give its technical working group — a coalition of government and industry experts — time to find answers to the problem. "The trouble is, the FBI doesn't even know the scope of its problem," said one legislative aide. However, sources said, the revised bill is likely to create a new round of debates within congressional subcommittees.

"The FBI and Justice got [FBI Director William] Sessions and [Attorney General William] Barr to personally endorse the proposal, and created an artificial sense of urgency," a staffer

methods of providing the Bureau with what it wants. "We think we can give them the [digital wiretap] ability, but we don't want to have to do it as a result of legislation," he said.

communication technology, minus constitutional protection of rights to assembly, speech, privacy, and freedom from

said. Now that Sessions and Barr have made impassioned appeals to Congress for the bill, "they can hardly just let the matter drift into the background," a staffer said. "It's tough legislation to do quietly," said another Hill aide.

The bill's new language still leaves in doubt questions of privacy, civil liberties, and network security. All were raised in debate on the original proposal in several intense congressional hearings. One of the proposal's most vocal critics, Representative Don Edwards (D-Cal.), former FBI agent and chairman of the House Constitution Subcommittee, said: "From what we can tell, the new proposal doesn't resolve the very serious concerns we had about privacy, civil liberties and security of the telephone system."

Another congressional source said that the new proposal "basically mandates the government to design a phone system intended to create a monitoring capacity," which would leave it open to manipulation from inside or outside government, creating security problems "at the very time when we're trying to make our telephone systems more secure."

The FCC wouldn't commit on the revised proposal, saying it hadn't seen the new language. However, said an FCC source, "If the FCC has been taken out of the loop, that's a good sign. We didn't want the responsibility anyway." FBI special agent Barry Smith, of the Bureau's Congressional Affairs Division, wouldn't comment on the extent of the changes, saying only: "We're taking input from everyone, from government to industry, and trying to come up with a workable solution."

As a group, RBOCs are "fully cooperating" with the FBI during several technical sessions, said one member of an ad hoc technical panel brought together by the FBI to ferret out the best

Although law-enforcement officials are currently at loggerheads trying to figure out the technology, Lauren Weinstein, owner of Vortex Technologies in Topanga, California, thinks the matter is really "just a wash." Digital technologies should make the act of wiretapping easier, not more difficult, he says.

The key to the problem, in Weinstein's opinion, is to think of the telephone network as just one huge computer network. He breaks the problem down like this: "In that kind of environment, the decision where the data stream goes is a software decision. The switches themselves are not buildings full of relays, but are just computers, manipulating streams of numbers. From the technical standpoint, the problems of wiretapping are trivial in such an environment."

All law enforcement types have to do is take this data stream and have it shunted off to more than one destination. For example: three-way calling, which is directed by software. Digital wiretapping could be considered a unique kind of three-way calling, where the third party comes in and the other two "simply don't know about it," Weinstein says. "It's really nothing more complicated than a good software problem."

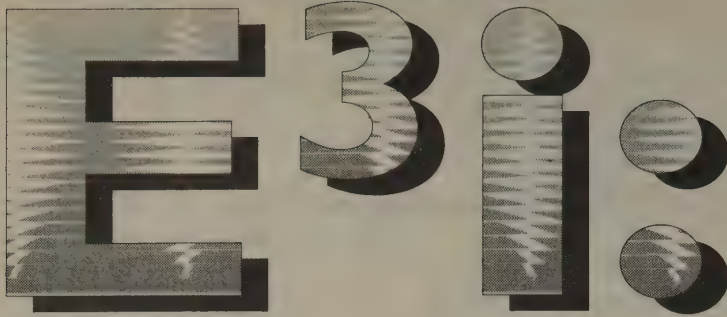
But the bill has its share of hurdles on the Hill. Lawmakers aren't buying the FBI's arguments that major drug investigations and other law enforcement efforts (such as the breaking of child pornography rings, often cited by the FBI when it defends this bill) could be hindered by technological advancements in the telephone industry.

A major source of skepticism is the FBI's own admission that it has yet to bungle a criminal investigation because of any inability to tap into phone lines. However, director William Sessions has told Congress in testimony

unlawful search and seizure, equals computer-aided tyranny: the flip side of "electronic democracy." Robert Steele's article on page 74 is one look at the future of the American intelligence community in the post-cold-war era. Brock Meeks, a reporter for a Washington, DC-based trade journal, *Communications Daily*, gives us a different angle. He's been following this story since it broke in March. Meeks's last article for WER was "The Global Commons" (WER #71, p. 20). —Howard Rheingold



that he fears such a time is near. "It's absolutely essential we not be hampered," he said. Sessions has continually fought off suggestions that the digital wiretap problem could be handled through agency-industry cooperation, obviating any need for legislation. "There are so many different companies, so many different interests, and unless we take the digital telephone and do it by statute, and provide some mechanism whereby that cooperation can be fostered as well as the law followed, we're going to find ourselves without the capability," he said. ☺



Ethics, Ecology, Evolution, and Intelligence

Government is not built to perceive large truths; only people can perceive great truths. Governments specialize in small and intermediate truths. They have to be instructed by their people in great truths. And the particular truth in which they need instruction today is that new means for meeting the largest problems on earth have to be created.

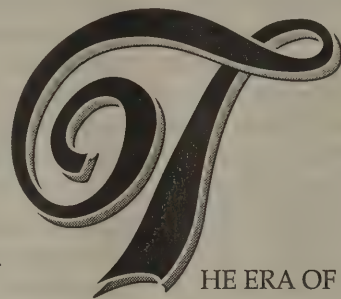
—Norman Cousins¹

The shock waves from the collapse of communism are still destroying historic old structures, particularly in Washington. Change agents, long dormant or ignored, are suddenly popular.

Not long after I read "Army Green" (p. 58) and met John Petersen, author of "Will the Military Miss the Market?" (p. 62), I started getting faxes from a fellow in the U.S. Marine Corps Command, Control, Communication, and Intelligence Department. Robert D. Steele wanted to talk about his hopes for restructuring the intelligence mission and redefining national security. And he wanted me to talk to representatives of the intelligence community about transforming themselves into an intelligent community. I greeted his ideas with polite skepticism, to which he responded by sending me some of the things he had written for intelligence journals about "open-source" intelligence. That means making intelligent use of publicly available information, instead of covert and classified sources. There are some wild-eyed radicals out there, all right, and some of them are in the Pentagon!

Who knows? Maybe Steele is a visionary, one of the first to see that the intelligence agencies of the Cold War era might be forced by circumstances to redefine their mission to take into account the dire state of the biosphere. Stranger things have happened lately.

Robert Steele, by his own description, is: "... a former Foreign Service officer and Marine Corps infantry officer, holds two graduate degrees and is a distinguished graduate of the Naval War College. He has spent most of his life in Latin America and Asia, and is of Hispanic heritage. As a Marine Corps civilian he was responsible for standing up the new USMC Intelligence Center in Quantico, where he developed many of his views about the relative utility to his Marine Corps consumers of unclassified versus classified information." —Howard Rheingold



THE ERA OF NATIONAL intelligence, with its unsung heroes and occasional rogue elephants in the war against communism, socialism, and other perceived evils, has come to an end. The Department of Defense and the national intelligence community are striving to restructure, desperately seeking to preserve a semblance of their once massive organizations. Both are redefining their roles and missions in order to remain competitive in the budget battles of the future.

The brain and heart of the national security "firm" have always been command and control, communications, computers, and intelligence, known by the acronym C³I. I propose an alternative paradigm for the intelligence community of the twenty-first century, one which focuses on objectives and outcomes rather than sources and methods. My approach, which integrates ethics, ecology, evolution, and

intelligence (E³I), represents a radical change in perspective on what we should be emphasizing as we adapt to our changed circumstances and prepare for future challenges. Such a paradigm could be described as the “open books” equivalent of the “open skies” concept being applied to arms control: the true value of “intelligence” to our nation lies in its informative value, a value which increases with dissemination. The emphasis within our national intelligence community should be on open sources, free exchanges between government and private-sector analysts, and unclassified production.

We have an opportunity to recast our national intelligence apparatus, and truly put it in the national service — that is, the service of the public — rather than repeat its

which we must grapple if we are to manage our national security, and the intelligence community, in a responsible fashion.

First, how do we define national security? Do we limit ourselves to “megaprotection” — strategic nuclear and conventional deterrence — while ignoring domestic crime, the loss of economic competitiveness, and the degradation of our external environment and our internal competence (a combination of character and education)? If “national security” is defined as the preservation of our national culture, of our way of life, of the conditions which permit the pursuit of happiness and prosperity, then something is seriously wrong with both our defense structure (including law enforcement), and our “national” intelligence capabilities.

If the nation is defined as the citizenry and its commonweal, rather than as the political apex of the government bureaucracy, then a radical new interpretation of the mission, sources, and methods of the national intelligence apparatus is required.

history of servitude and sublimation in the shadow of a restricted, myopic group of policy-makers whose circumstances have frequently precluded long-range planning and rational (as opposed to political) decision-making. I propose to link national intelligence with national competitiveness in a very tangible way, making intelligence the apex of the knowledge infrastructure, and the catalyst for a dramatic improvement in our ability to recognize change and opportunities for advantage. Only in this way can we quickly retrain our people, retool our plants, and revise our product lines so as to maintain a prosperous, profitable nation.

There are three questions with

Second, who is the customer for national intelligence? Is it the president, who has little time to digest or consider the distilled product of a multibillion-dollar global network of human and technical capabilities? Is it the top one hundred government officials? Is it Congress? Is it a combination of congressional staffers and executive-branch action officers? Or could “the customer” include the media, the academy, and the private sector?

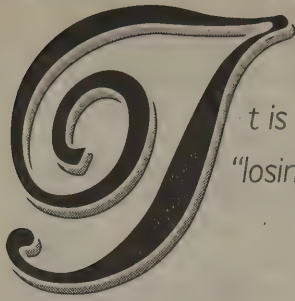
Third, given a sense of national security (however defined) and an adequate definition of the customer base that national intelligence is meant to serve, the final question must be: “What is our objective?” To what *end* do we wish to main-

tain a national intelligence capability? Is it to warn us of threats (unprovoked nuclear attack, biochemical terrorism, computer “hit-and-run” assaults)? Is it to inform us of systematic campaigns to undermine our economy, our sociology, or even our biology? Or is it part of a “commonwealth” sensor system, intended to monitor our internal and external stability, to educate our officials, our citizens, and our foreign partners regarding emerging conditions, organizations, and personalities inimical to “steady-state” evolution? If the nation is defined as the citizenry and its commonweal, rather than as the political apex of the government bureaucracy, then a radical new interpretation of the mission, sources, and methods of the national intelligence apparatus is required.

Such an interpretation is intended to make national intelligence more relevant to what should be two top national priorities: the preservation of our culture and a strong ethical foundation for that culture; and the preservation (indeed, the restoration) of our environment. Intelligence can play a very significant part in the recasting of our national government and its relationship with the private sector; intelligence can be teacher, mentor, lifeguard, and coach. National intelligence is an essential element of our national competence, vision, purpose, and cohesion. Only a small fraction of national intelligence should be “classified”: while some classified information is essential to effective diplomacy and executive action, the classification and restriction of knowledge are inherently counterproductive and fraught with the risk of corruption.

Ethics and Intelligence

After seventeen years’ experience in government, I am convinced that secrets are inherently pathological, undermining reasoned judgment and open discussion. With the exception of relatively limited technical information and



It is now clear to all of us that we are "losing our mind" as a nation.

some information about plans and intentions, most of what we want to know is readily and cheaply available through the art and science of scholarship and personal interaction.

It is one of the great tragedies of our time that scholarship has lost so much ground, has been forced into mediocrity by the pressures of time, overload, and plain human failure. A lack of ethics and credibility in the academic community leads directly to ethical abuse in the intelligence community, for even when hiding behind secrets, the intelligence community has always been vulnerable to the detection of ridiculous assumptions by articulate and insightful scholars.

A wise man once said, "A nation's best defense is an educated citizenry." One could make the case that knowledge is the foundation of democracy, and that without an "open books" approach to national knowledge, we are destined to become the slaves of the rich, or worse. The purchasing and securing of patents for more fuel-efficient engines, "indestructible" polymeric paints, and other good ideas, solely to protect investments in archaic industrial plants, illustrate the problems that occur when knowledge is treated as property. Individuals end up paying much more for certain products, both because of inefficient production processes and because there is insufficient knowledge of external diseconomies such as pollution and waste.²

My proposed paradigm in no way allows for the establishment of a government monopoly on information handling, or government control over the way we manage data

and knowledge. On the contrary, this paradigm forces the issue of "who owns knowledge?" (I maintain it is in the public domain) and severely limits the degree to which any organization, in or out of government, can withhold knowledge from the public.

Environment and Intelligence

We are our own worst enemy. Although there is a healthy increase in interest by our national leadership in environmental intelligence, it is directed outward. The data obtained by national intelligence about external environmental conditions and practices must be fully integrable with state and local data on environmental conditions and practices. Only in this way can we reasonably assess the "cost" of a specific product in relation to both inefficient production processes (which consume raw materials in excess, and produce waste and pollution which also "cost" the individual in terms of resources, time, and money required for mechanical disposal), and environmental degradation. Taken in combination, what we are doing to the environment through tacit sanction by our national energy, trade, defense, housing, and education policies is far worse, every day, than a whole series of Chernobyls.³

Evolution and Intelligence

The Cold War cost us both resources and perspective. Because of the Cold War, we paid no attention to "lesser" threats and circumstances which, we are now begin-

ning to recognize, represent a cumulative threat to our survivability and prosperity. These are subtle threats, difficult to observe and understand, and the remedies are also subtle, difficult to articulate and implement. As a result, we are now in the same position as a forest ranger who, for being so intent on avoiding the bear, fails to see the encircling fires. Now both the ranger and the bear are about to be burned alive.

Evolution requires recognition of change, flexibility of posture, and fleetness of adaptation. There are only two ways to "force" evolution: through overwhelming force, a role this nation will never accept (we *could* have turned our forces loose on the Middle East and totally eliminated all weapons in both the Arab coalition and Israel); or through education. This latter approach (the preferred solution for a democracy) requires an educated citizenry. It is now clear to all of us that we are "losing our mind"⁴ as a nation; I see national intelligence, and a presidential initiative in conveying to every citizen the nature of the nonmilitary threats to our survival, as the only means of catalyzing our educational system into reform. From education comes evolution — the alternative is deepening depression and ultimate chaos, as the nine regions of North America choose to fend for themselves, and ethnic fragmentation takes its toll on the commonweal.

Where do we start? I see intelligence as part of a continuum, or a larger national construct, which must also include our formal educational process, our informal cultural values, our structured information-technology architecture, our informal social and professional networks for information exchange, our political governance system extending not only internationally but down to the state, local, and citizen level; and, as traditionally defined, as an integral element of the federal bureaucracy.

Again, with a genuflection toward

civil libertarians, I must stress that my "open books" approach to a national knowledge architecture in no way creates a government monopoly or increases government opportunities to impose "necessary illusions"⁵; on the contrary, this approach to knowledge represents a radical departure from the current practice of allowing organizations to conceal and manipulate knowledge against the common interest.

On this basis, one can suggest that Congress and the Executive would be seriously remiss if they were not moving aggressively toward a national open-systems architecture and simple, direct connectivity between public and private educational institutions (e.g., reference librarians and library search systems); corporate marketing and research centers; state and local government information centers; ethnic, religious, and other cultural information "gatekeepers"; and, ultimately, any citizen's computer terminal.

That is the long-term objective. A measure of our situation today is the degree to which the intelligence community is integrated with all of the departments of the federal government (Agriculture, Commerce, Education, Energy, Housing and Urban Development, Interior, Justice, Education), not just the traditional national security departments (State, Defense). The answer is not good. In fact, it is very bad, for even the traditional customers must receive their "intelligence" in bulky compendiums of hard-copy,

most of it overclassified, too narrowly focused, and untimely enough to be almost useless when contrasted with the flood of "good enough" open-source material (which does not need a mass of security guards to register and control the data). The nontraditional consumers at the federal level receive little or no intelligence support, and there is no systematic integration, correlation, or comparison of the open-source information they use with the secret data of the intelligence community.

Priority to People

What steps must we take today to achieve an integrated national intelligence system by the year 2001?

The intelligence community spends too much money on extremely expensive technical collection systems, whose flood of digital information cannot be processed by existing or planned methods and personnel. Less than 10 percent of what we collect with these systems is processed, calling into question the return on investment. Our analysts are few in number, and generally inexperienced — few analysts responsible for the study of a particular country, for instance, have ever actually lived in that country, learned the language, or gotten to know the social nature and cultural character of the people about whom they are supposed to be "expert."

Our analysts are also cloistered away from their customers, the policy-makers and the action

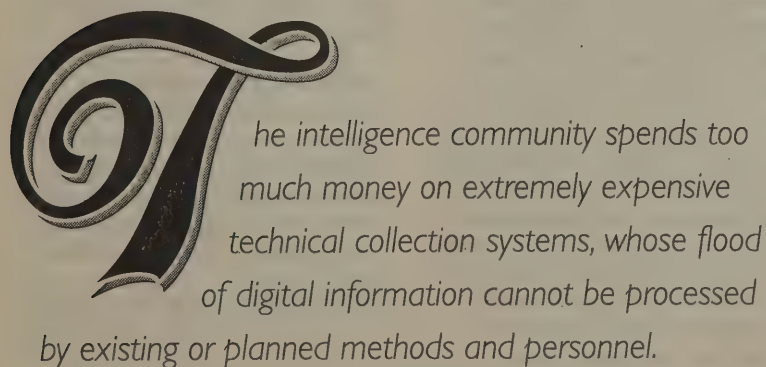
officers, and have little significant interaction with their academic, industrial, and foreign counterparts — in part because of security restrictions and in part because intelligence management refuses to give them the time to travel, train, and reflect. Analysts are instead chained to their desks, force-fed a dry diet of hard-copy intelligence, deprived of most open-source materials, and expected to "produce" sterile, uncontroversial, "objective" reports.

In my judgment, analysts should spend one-third of their time traveling and training, one-third working directly with consumers (including academic and industrial consumers), and one-third doing *analysis* that may or may not result in a product. We should nurture private-sector analysts as well as government analysts, perhaps by providing joint training programs, joint travel opportunities, and so on.

Priority to Open Sources

I have written elsewhere⁶ about our desperate need for a National Information Agency, an agency untainted and unbiased by association with the traditional intelligence community. Elements of the government now dealing with open sources should be consolidated in such an agency and granted an independent charter to enable them to support not only the intelligence community, and the remainder of the federal government that has been starved for information, but also the private sector and even foreign organizations as appropriate.

Such an agency would not be successful without a direct congressional charter and separate program, and I therefore recommend that Congress follow the precedent it created with Special Operations/Low Intensity Conflict, and create a Consolidated Open Source Program. A significant portion of the funds in this program should be used to build upon the funds appropriated for the National Security Education Act of 1991, and used



The intelligence community spends too much money on extremely expensive technical collection systems, whose flood of digital information cannot be processed by existing or planned methods and personnel.

to dramatically upgrade educational programs (beginning in elementary school) and industrial information resources devoted to our knowledge of the international physical, political, economic, and cultural environment.

Priority to Open Systems

The issues of privacy and computer security aside, there is much to be said for accelerating the electronic connectivity of the nation; as quickly as possible, every government action officer should be made accessible through Internet-like channels, and every university professor, high-school geography or history teacher, business executive, and student should be part of a national network of readily identifiable individuals with common interests.

The National Research and Education Network initiative (WER #70, p. 12) is a good one, but if we do not provide for the rural roads and comfort stations needed by *individuals*, this initiative will be of little value to the broad population of literate persons requiring rapid access to multimedia knowledge. I would move the government, including the national security structure, to an unclassified open-systems baseline, and sharply reduce the production and dissemination of classified information while increasing the availability of government-collected and -generated information to the public through electronic channels.

Consumers of intelligence — including the highest policy-making officials whom the multibillion-dollar community considers its most important customers — have often stated that they would rather have an unclassified surrogate that is “good enough to work with” than a highly classi-

fied, extremely accurate photograph or report that they cannot share with their counterparts. Analysts should be able to use classified information to inform themselves and validate their views, but they should focus production efforts on the unclassified side, providing information that can go not only to individual government consumers, but also into the public domain through open architecture.

Redefine National Security

A presidential blue-ribbon commission, comprising representatives of various industries, academic sectors, and major departments of government, should be brought together to redefine national security and our national strategic objectives. Some progress has been made in this direction through National Security Review 29; the results, which include significantly increased emphasis on the environment as a “target” for collection and analysis, are nevertheless in-

adequate, in that we have not truly come to grips with what our changed national strategy should be, nor with what changes should take place in relations between our government and the private sector, between our nation and other nations, and between US non-governmental organizations and foreign or international nongovernmental organizations.⁷

In brief, as nuclear and conventional forces cease to be the arbiters of power; as many (though not all) nation-states regress to pre-sovereign conditions; and as other forces (economics, environmental changes, and ideocultural movements) come to the fore as key areas of competition and challenge, we need to redefine who our national intelligence consumers are. In economic warfare, our private sector (industry, academia, and the citizenry) provides the “troops,” and thus requires the kind of support that intelligence has previously provided to the tactical commander. In ideocultural competition, it is primarily private-sector organizations

Notes

1. *The Pathology Of Power* (Norton, 1987).

2. For an interesting examination of how an industrial system also undermines the moral foundation of a society — kinship — and thus establishes the foundation for national and industrial decision-making against the best interests of people *qua* people, see Lionel Tiger, *The Manufacture of Evil: Ethics, Evolution, and the Industrial System* (Harper & Row, 1987).

3. Walter Truett Anderson's *To Govern Evolution: Further Adventures of the Political Animal* (Harcourt, 1987), while as yet obscure, is in my judgment as important to our future as the *Communist Manifesto* was to Lenin and company. If Anderson or someone like him is ever president, I want to be his national information advocate.

4. I take this notion from Chester E. Finn, Jr.'s *We Must Take Charge: Our Schools and Our Future* (Free Press, 1991); two other books of note, both focused on content, character, and culture, are those of Allan Bloom, *The Closing of the American Mind* (Touchstone, 1987) and William J. Bennett, *The Devaluing of America: The Fight for Our Culture and Our Children* (Summit, 1992).

5. I take this phrase from Noam Chomsky's *Necessary Illusions: Thought Control in Democratic Societies* (South End, 1989). See also Edward S. Herman and Noam Chomsky, *Manufacturing Consent: The Political Economy of the Mass Media* (Pantheon, 1988).

6. “Applying the ‘New Paradigm’:

that require an improved understanding of their "competition" and of the demographic playing field upon which they are competing. We no longer need multibillion-dollar investments in systems designed to cover strategic nuclear missiles; instead, we need a multibillion-dollar investment in national knowledge architectures, and global collection, analysis, and dissemination sources and methods that are *open, free, and unclassified*.

These thoughts are consistent with those of Mitch Kapor and his concept of a National Public Network (*WER* #74, p. 72). My point is a simple one: national power ultimately stems from the people, even if that power might be abdicated by the people or co-opted by the rich and political. Knowledge is power, and one could say that the people require and will obtain knowledge in one of two ways: by participating in a cooperative venture in which the government facilitates and nurtures information exchange, in much the same way that it facilitated interstate com-

merce; or through revolution, in which the people, aided by hackers, break open the vaults of knowledge and refuse the government and private-sector organizations their current privileged access to knowledge that merits dissemination and exploitation.

For those concerned about the protection of privacy, with civil-libertarian issues, I would again stress that my concept of national intelligence is focused on collecting predominantly open information about conditions and entities beyond our borders, for the purpose of informing our public and private persons; my concept does not call for the collection of information about people within our borders — in fact, were knowledge about our people necessary (for demographic studies, census reviews, etc.), I would be among the first to call for "electronic aliases" in which it would be illegal to associate a true name with any compiled information about more than one person. By stressing the prominence of *unclassified* information, we essentially

provide our public with an "open-books" approach to knowledge and government management, while significantly increasing the synergy between private-sector data and public-sector data.

Our progress in taming the electronic frontier must be accompanied by a maturing of our national policies and laws; without such changes in the political and legal environments, technical progress will exacerbate the conflict between citizens and organizations, leading ultimately to revolution and electronic anarchy. Early adoption of an alternative paradigm — one that integrates ethics, ecology, and evolution, as fundamental aspects of national intelligence, and puts national intelligence in its place at one end of a continuum of information and education services to the people — could avoid the conflicts inherent in our current chaotic electronic environment, while accelerating our ability to recognize and adapt to changed circumstances.

As civilization has evolved, and the sources of power have changed from tribal mass to political force to financial leverage, each era has faced the challenge of adapting to change. We have reached a turning point, one where the ultimate source of power is finally recognized — knowledge. I conclude with an observation from Will and Ariel Durant, who, in their lifetime of studying civilizations, came to the following realization:

*The only real revolution is in the enlightenment of the mind and the improvement of character, the only real emancipation is individual, and the only real revolutionists are philosophers and saints.*⁸

How to Avoid Strategic Intelligence Failures in the Future," *American Intelligence Journal* (Autumn 1991), pp. 43-46.

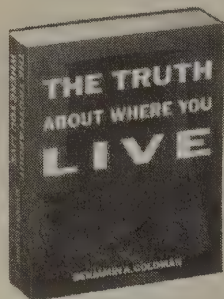
7. I hold the view that government cannot abdicate its role in nurturing our culture and its educational foundation — that statecraft is indeed soulcraft; and that government expenditures are less important with respect to what they actually purchase in services, and more important in terms of their influence on the private sector: government expenditures should establish a foundation that encourages private sector outlays in positive ethical and environmental directions. Among the books that have influenced my thinking are those of George Will, *Statecraft as Soulcraft: What Government Does* (Simon & Schuster,

1983); William Lind, *Cultural Conservatism: Toward a New National Agenda* (Institute for Cultural Conservatism, 1987); Herbert Stein, *Governing the \$5 Trillion Economy* (Oxford, 1989); Albert L. Malabre, Jr., *Within Our Means: The Struggle for Economic Recovery After a Reckless Decade* (Random House, 1991); and David M. Abshire, *Preventing World War III: A Realistic Grand Strategy* (Harper & Row, 1988). The latter book, despite its title, is a superb description of how the president should take charge of long-term policy planning across all dimensions of our domestic and foreign environment.

8. Will and Ariel Durant, *The Lessons of History* (Simon & Schuster, 1968), p. 72.

The Truth About Where You Live

This book surveys the incidence of mortality and disease, plotted by locale, and mapped by US county in irrefutable, appalling, worrisome detail. I can almost guarantee you will find unwelcome surprises here. It's accompanied by suitable explanation and a past-due call to arms. It's magnum ammunition for activists. I can just hear you furiously thumbing pages to find out how your area is rated. (Mine is so-so.) As R. Crumb says, there's no peace for the living. —J. Baldwin



The Truth About Where You Live

(An Atlas for Action on Toxins and Mortality)

Benjamin A. Goldman,
1991; 416 pp.

\$17 (\$19 postpaid) from Random House/
Order Dept., 400 Hahn Road, Westminster,
MD 21157; 800/733-3000
(or Whole Earth Access)

• Epidemiologists untangle such questions by classifying the causes of disease according to three factors:

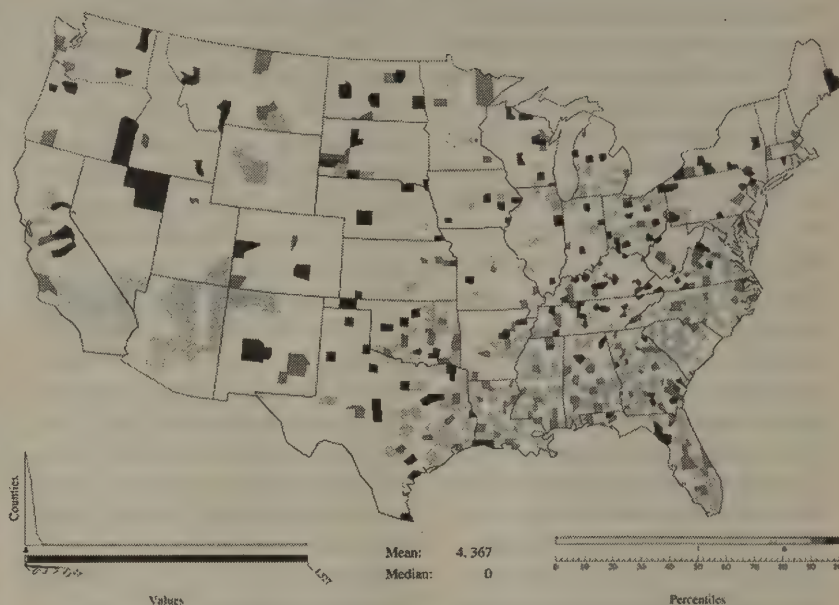
• *Agents of disease* are specific factors that contribute to ill health — bacteria, viruses, toxic chemicals, ionizing radiation, cholesterol, and others.

• *Host factors* (or intrinsic factors) are personal characteristics that influence susceptibility or response — age, sex, social class, ethnicity, genes, behavior, nutritional state, heightened chemical sensitivity due to previous exposures, and the like.

• *Environmental factors* (or extrinsic factors) include any aspect of the physical, biological, or societal environment that influences the existence of an agent and exposure or susceptibility to it — food sources, occupation, economic conditions, government regulations, housing, climate, ambient pollution, and so forth.

This is a useful scheme for understanding causes of disease, but in reality these factors interact in a way that demands an appreciation of ecological interrelationships.

Child Cancers: Minority Mortality Rate (deaths per 100,000 children)
Top [worst] counties shaded black.



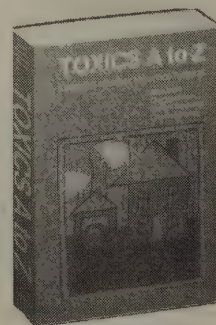
Toxics A to Z

Comprehensive descriptions of 100 common pollution hazards — their effects, antidotes and control — are brought together in this useful, readable, though obviously not spellbinding guide-book. A respectable short course on the subject accompanies the discussion of specific toxics. Handy and authoritative, it's pleasingly free of emotional whining. —J. Baldwin

• Because of its low water solubility, toluene in the atmosphere is not appreciably removed by rain and thus it can travel long distances downwind from its source. Nevertheless, levels of toluene in the air around gas stations are higher than those likely to be encountered elsewhere by the public. This is particularly a problem at gas stations where nozzles lack vapor barriers. Because of the standard petroleum industry practice of disposing of a small fraction of toluene wastes into rivers, lakes, and oceans, toluene is now found in Gulf Coast waters adjacent to the major U.S. petrochemical manufacturing area at concentrations that far exceed natural background levels. Cigarette smoking is another source of toluene exposure, both to the smoker and the passive bystander. Exposure to toluene also results from the use of oil-based paints and inks, resins, and solvent-based glues.

• Intentional sniffing of model glue, which is composed mainly of toluene, can cause malfunctions of the nerves that control

movement and irregular heart rate; in some cases, it may lead to death. Long-term exposure to toluene may lead to kidney and liver damage. Exposure of pregnant women to toluene has been associated with damage to the unborn child. Interestingly, ethyl alcohol (the alcohol in beer, wine, and liquor) causes most of the toluene in a person's body to migrate to the blood, resulting in increased exposure to vital organs such as the brain (see Chapter 7, Section B).



Toxics A to Z

(A Guide to Everyday Pollution Hazards)

John Harte, Cheryl Holdren,
Richard Schneider, and Christine Shirley,
1991; 479 pp.

\$29.95 (\$32.95 postpaid) from California/
Princeton Fulfillment Services/Order Dept.,
1445 Lower Ferry Road, Ewing, NJ 08618;
800/777-4726 (or Whole Earth Access)

Ecopreneuring

Wearing my Environmental Studies Instructor hat has taught me that many folks of good heart and mind don't know what to do when they get out of school or an unsatisfying job. "There aren't any environmental jobs for us" is often heard. Well: there are jobs out there, though you may have to look around imaginatively. Failing that, you may have to generate one — not unreasonable in such a new field. Here's how to start. Many good tactics and strategies for starting any small enterprise can be found here; the special pitfalls awaiting the unwary ecobusiness are well presented. There are lots of inspiring success stories. As far as I know, this is the only book out there that gets at these things in such welcome detail.

—J. Baldwin

Having managed a natural-food store in the early 1970's, Arnie had seen first hand how many new products appeared on the shelves week after week. He was especially impressed by such products as organic pet food and all natural snack foods.

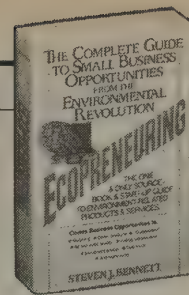
"It seemed to me back then," Arnie remembers, "that our priorities were some-

how messed up. We were feeding our pets better than we were feeding our babies."

He figured that someone, somehow, would eventually come up with a natural baby food, one that parents would feel secure about feeding to their children. But by 1984 no such product had appeared. While discussing that fact with his brother Ron, who was a new father, something clicked in Arnie's mind. The next morning at the breakfast table, he told his wife that he was going to develop and make a pure baby food that was simply . . . the earth's best.

What the brothers had in mind was nothing short of a revolution, a David-vs.-Goliath battle with the likes of Beech-Nut, Gerber, and Heinz, the giant trio of mass-market baby-food producers. They envisioned a complete line of baby foods made from healthy, organically grown fruits and vegetables. No additives. No sugar. No salt. No flavorings. No preservatives.

As good as the idea sounded, the task was formidable; there were good reasons why only three big makers of baby food had survived. For one thing, manufacturing baby food requires a substantial investment in equipment, research, development (making up recipes and testing them), and distribution. The maker of a food product must in-



Ecopreneuring

Steven J. Bennett, 1991; 308 pp.

\$17.95 postpaid from John Wiley & Sons, Inc./Eastern Distribution Ctr., 1 Wiley Drive, Somerset, NJ 08873; 800/848-8298 (or Whole Earth Access)

vest heavily in quality control, ensuring that the product will taste the same, batch after batch. The baby-food maker must also pay high insurance premiums and worker's compensation, since to make food in volume requires heavy machinery. . . .

By early 1991, Earth's Best products were being carried in natural-food stores and supermarkets in 20 states, and the company could point to the following accomplishments:

- It was the first to introduce the concept of commercial organic baby food in the United States.
- It was the first to distribute organic baby food nationally in natural-food stores and supermarkets.
- It was the first to obtain shelf space in the baby-food aisle, not in the specialty or health-food aisles, for such a product.
- It was the first to produce an entire line of juices for babies without using concentrates.
- It was the first to develop whole-grain instant cereals for babies.

● Only use plastic financing in the following circumstances:

1. When you need a small supplemental loan that you know you can repay in the next three to six months.
2. When you need to purchase inventory that you are sure will move within 30 days of hitting your shelf.
3. When you need to acquire a piece of equipment that will pay for itself fast enough to generate the monthly payments plus interest.

Never use plastic to:

1. Meet payroll.
2. Carry you through a down period of six months or more.
3. Pay for basic capital investments (chairs, desks, etc) that will never pay for themselves in any tangible way.

The Wellness Encyclopedia

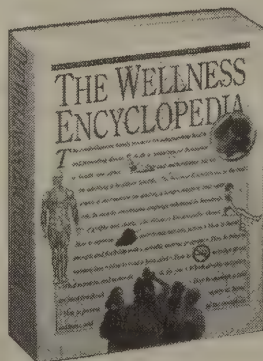
Get by the New Age title, and you find a trove of information you need to know to stay well. Not an airhead idea in the bunch — this comes from The University of California, with all that implies. The essential stuff is laid out in neat rows. Hype and myth are summarily debunked. It's especially good at helping you make health decisions in areas where you have little knowledge. Easy to read and find your way around in, it's something everyone should have handy. —J. Baldwin

Like the oil that comes from it, coconut is one of the richest sources of saturated fat. Three-quarters of the 100 calories in an ounce of raw coconut come from saturated fat. But like all plant foods, coconut is cholesterol-free.

Colon cancer is the second most common form of cancer in the United States; it kills more people each year than automobile accidents. And yet, the American Cancer Society estimates that fully three-quarters of all colon cancer patients could be saved by early diagnosis and treatment.

Early diagnosis of colon cancer requires discovering occult or "hidden" blood in the stool — that is, the merest trace of blood,

which shows up in the earliest stages of the disorder. Since diagnosis requires examining a stool sample, and many people find it embarrassing or unpleasant to bring one to a doctor, many simply avoid being tested. Yet everyone over age fifty — certainly anyone whose family has a history of colon cancer — should be tested every year.



The Wellness Encyclopedia

Editors of The University of California, Berkeley, Wellness Letter, 1991; 541 pp.

\$15.95 (\$19.95 postpaid) from Houghton Mifflin Company/Mail Order Dept., Wayside Road, Burlington, MA 01803; 800/225-3362 (or Whole Earth Access)

Paradigms in Progress

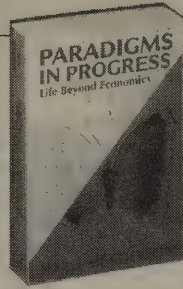
Hazel Henderson has been assailing the bastions of Establishment Economics for more than 15 years now, and is at last being recognized by the people who have their hands on the controls. Some see her ideas as unrealistic, or worse, but more and more see her insights as useful in explaining what is happening, this very day, and in particular, what can and should be done to correct our obviously flawed economic policies (assuming there are any). Her environment- and people-including replacement for GNP as an indicator of economic health seems especially effective.

Here she presents her tightly argued ideas in far more detail than in her previous books. In the best Henderson style (in contrast to the usual economic reading fare), you can actually read her clear, jargon-free writing without falling out of your chair. You need to know this stuff.

—J. Baldwin

As Third World debt is put behind us, the global playing field can be buttressed by placing an ethical floor under it, one composed of an extended girder work of agreements and protocols on toxic chemicals, worker and consumer protection, environmental standards, and eventually leveling some of the really serious differentials in wages (measured not in GNP terms, but in purchasing power parity equivalents [PPPs]). These differentials in exploiting human labor, just like excessive differentials in consumer and worker safety and environmental protection, are what drives the excessive, unhealthy migrations of populations across borders looking for work and companies looking for short-term market advantage. These massive migrations further fuel the globalization processes and the 24-hour-day financial casino, where money is divorced from real wealth and becomes mere blips of information on thousands of trading screens, where time windows of opportunity to exploit differentials in currencies and interest rates are collapsing to mere nanoseconds.

Much of this ethical girder work of treaties, agreements, and protocols to raise the ethical floor to level the global playing field is already in place, through the United Nations special agencies and such treaties as that in Montreal in 1987 on chlorofluorocarbons and the Law of the Sea, which has been waiting for the United States to ratify

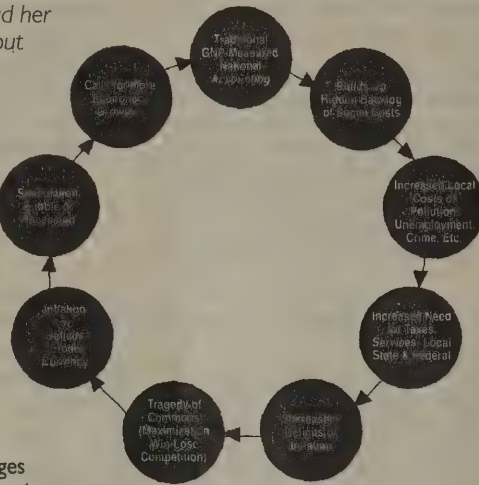


Paradigms in Progress

(Life Beyond Economics)

Hazel Henderson, 1991; 293 pp.

\$16.95 (\$18.70 postpaid) from Knowledge Systems, Inc., 7777 W. Morris Street, Indianapolis, IN 46231; 800/999-8517 (or Whole Earth Access)



Old Unsustainable Economic Development Treadmill.

it after a decade of delaying tactics. Only when this ethical girder work is in place, can ethically aware, responsible companies live up to their moral codes without fear of unfair competition by others willing to cut corners and exploit people and the environment for short-term gain.

The “doves” in both North and South argued that, in order to more accurately represent resource consumption patterns, gross population figures should be interpreted differently. For instance, the “Indian Equivalents” formula should be widely encouraged (an American baby’s impact on world resources is at least 50 times that of an Indian child). By these calculations, the U.S. population must be figured in the tens of billions, and viewed as the biggest contributor to the global population problem.

Virtually all countries, including China, still see their “security needs” mostly in military terms, and all measure national “progress” by the growth of gross national products (GNP). As noted earlier, the two measurements are not unrelated; GNP was introduced during World War II to focus on military production. A lasting peace, let alone a new world order, will require rethinking our definitions of security, progress and development — stretching them beyond the growth of GNP.

New definitions of a new world order must include security from environmental pollution, poverty, hunger, and disease; secure work based on a well-run economy; a sound infrastructure roads, railways and public buildings; and security from crime and illegal drugs. Now is the time for debate on the ways of shifting the world’s priorities and redirecting the current \$1 trillion a year spent on weapons toward investments in the areas of health, education, and environmental restoration.

The Smart Job Search

There are a LOT of competent how-to-nab-a-great-job books available. This one seems to be exceptionally straightforward and easy to use. Its terse advice is upbeat and wise, yet coldbloodedly realistic. Much of it arrives in the form of questions you must face, and answers you’d best have ready — almost like learning a part in a play, with you in the leading role, right down to tiny details of costume and demeanor. It’s especially good at coaching your mind-set, assuming you need help at that. A true guidebook by an experienced, wily guide. —J. Baldwin

“I just graduated from college with a 2.5 average. How am I going to land a great job?”

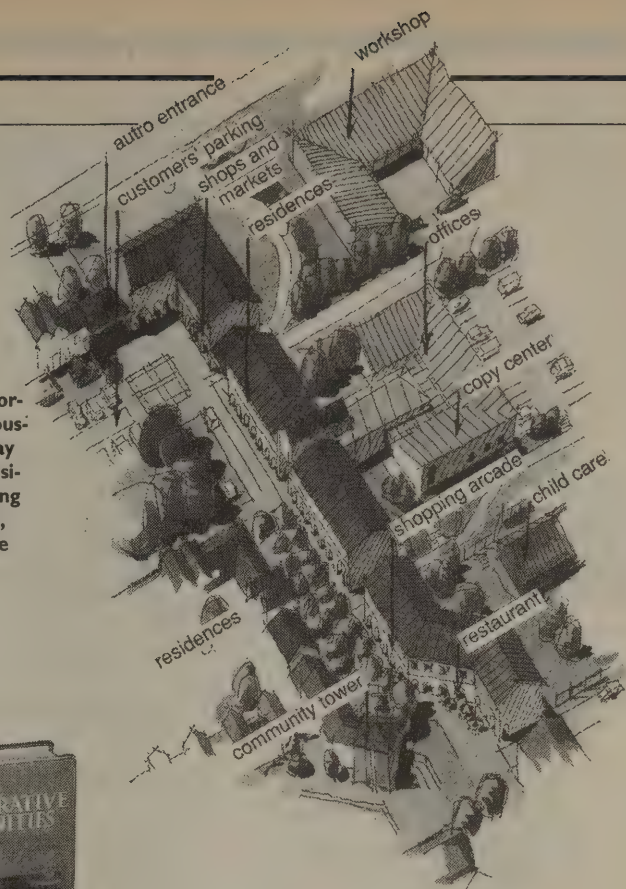
You also deserve congratulations. Did college teach you new skills? Did you graduate through your own efforts? Be proud of your efforts, not a statistical average. With regard to the job market, who says you have to advertise your grade average? The graduate with a 4.0 may have had no social life and thus no social skills, no associations with sports or the school newspaper, etc. What’s your story? Did you participate in sports? Were you working while attending school? Were you a lab or research assistant? Your 2.5 does nothing for the company. Your skills do.

When the offer is made, pause for a moment and look down at the ground or at your feet. Think about the offer and think about something really, really bad that has

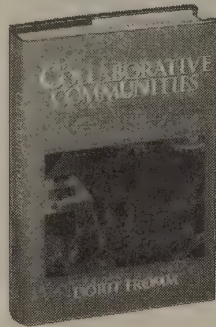
Collaborative Communities

US interest in cohousing was largely ignited by the conceptually exciting but narrowly focused **Cohousing** (Ecolog p. 73). This more comprehensive book identifies cohousing as just one of many community/neighborhood schemes that exist, are under construction, or are being planned here and abroad. It's a rousing assortment, wonderfully informed by the wide variety of people involved. A selection of closely examined examples is enlivened by photographs and drawings of the layout of both community and housing units. The nasty questions of organization, finance and bureaucracy are answered from often difficult experience. While not quite as enticing a presentation as **Cohousing**, this book will nonetheless add to the growing interest in this sort of living. Its wise, realistic information and advice will help build the deliberate communities that so many people are finding attractive.

—J. Baldwin



The urban neighborhood combines housing, local shops, day care, and small businesses located along pedestrian streets, with parking at the periphery.



Collaborative Communities

(Cohousing, Central Living, and Other New Forms of Housing With Shared Facilities)

Dorit Fromm, 1991; 296 pp.

\$44.95 postpaid from Van Nostrand Reinhold/Order Dept., 7625 Empire Drive, Florence, KY 41042; 800/926-2665

The urban neighborhood is a way to tie cohousing to the larger community, enhancing both. The idea is to integrate housing, businesses, and commercial services in an old-fashioned market town. The kinds of neighborhoods that people used to live in were very much an inspiration for cohousing, and the urban neighborhood attempts to recreate a similar concept on a larger scale. The first phases of the residences have been completed in two ambitious developments near Copenhagen.

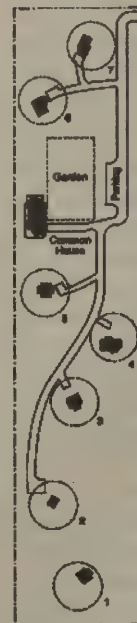
Each member, stake in hand, walked the site and stopped where he or she thought

the center of the house should be. The stake was pounded in. A 50-foot rope was tied to the stake, and a circle was drawn, with the stake as its center. The result was seven round sites, each with a 100-foot circumference, about 8,000 square feet. By using a circle, they did not need to lay out

four stakes. Surprisingly, this method worked well; there was no overlap of circles because each person had chosen a different site.

There are seven homes on the 8-acre site. The 7 "leftover" acres are held in common. The parking area is to one side, and there is a short walk to the homes.

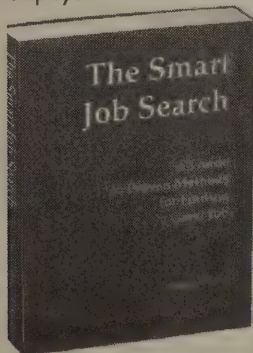
When the sites had been figured out, they went to a lawyer and asked, "How do we do that?"



Site plan of Herbie's. The seven circles are the privately owned lots for the houses. The remaining land is owned in common.

happened to you. Perhaps a failed exam, the death of a family pet, etc. After this 'very pregnant pause', look at the interviewer. Maintain eye to eye contact and ask "Is that the best offer you're able to make?"

If the answer to your question is yes, you thank them and say you'll need a day to come to your decision. You will need this day to fill out your Compensation Chart. A seemingly great offer may need some adjustments after you've had some time to consider it further. If further negotiations are necessary, one day will give you the clarity needed to present your demands to the employer.



The Smart Job Search

Marc L. Makos, 1991; 297 pp.

\$18.95 (\$21.45 postpaid) from HD Publishing, P. O. Box 2171-TSJS, Boston, MA 02106

LIFE AT THE BOTTOM



Illustrations by James Donnelly

MANAGEMENT PROBLEMS IN SOCIAL-CHANGE ORGANIZATIONS

BY JIM BRITELL

Jim Britell wrote "Negotiate To Win" in our Spring 1992 issue. In talking with him about that article, I mentioned some of the lurches, staggers, and changes in leadership going on here, at our own nonprofit Point Foundation. My tales of a board out of touch with a staff and assorted other woes were just more grist for Jim's mill. Turns out he'd been hearing similar stories from a lot of his nonprofit friends, and as a former manager, had begun to ask, "Why?" This article and the survey review of management books that follows are the result. —Richard Nilsen

*The best of all rulers is but a shadowy presence to his subjects.
Next comes the ruler they love and praise;
Next comes one they fear;
Next comes one with whom they take liberties.
When there is not enough faith, there is a lack of good faith.*

*Hesitant, he does not utter words lightly.
When his task is accomplished and his work done
The people all say, "It happened to us naturally."
—Tao Te Ching, Lao Tzu #17*

MANY NONPROFIT AND SOCIAL-CHANGE ORGANIZATIONS, working to make the world a better place, manage to create work environments that are social nightmares for their staffs. The lack of good management in many of these organizations often drives their most dedicated employees and volunteers away, frustrated and resentful.

In their study of job satisfaction in northern Rockies public-interest organizations,* Kuric and van Hook found that many groups treated their "good-hearted staff with callous disregard." They found widespread dissatisfaction with workspace, pay, relations

* See review of *Dancing in the Dragon's Jaw* (p. 92).

OF THE WATERFALL

with directors and boards; employees sensed that "they are less important than the causes they work on." Among employees who had quit, poor administration was a frequent complaint. When asked how the management of these organizations could be improved, former employees overwhelmingly singled out the need to improve the management and supervisory skills of the directors.

I discussed the findings of this report with individuals familiar with social-change organizations in other regions of the country. There was a consensus that many (perhaps a majority) of these organizations suffer because the managers lack management skills. One person, who conducts training programs for social-change organizations in the Midwest, observed that the overall quality of management in social-change organizations is not good. She sensed a feeling of isolation in executive directors, and said that few are caring, too many are workaholics that can't share power, and there is an expectation that staff members will sacrifice themselves.

Another who has worked for environmental organizations in the Northeast noted that these organizations are often headed by charismatic, even messianic people who do not like to see other charismatic people emerge from the organization or begin to take charge. An executive of a national charitable foundation in the Southeast who has overseen many community nonprofit organizations said that managers of nonprofit organizations are not taught to manage, and that lack of management skills is widespread. One organization he worked with had a director who

*A manager
oblivious to the social
complexities of an
office full of people
is a lot like the
manager of a
logging company
who is oblivious
to the biological
complexity of a forest
he is logging.*

let everyone know that he was the boss by routinely rejecting other people's ideas, just because they weren't his.

One person who worked for the Forest Service, and who now works for an organization whose primary purpose is to oppose the Forest Service's deforestation schemes, said, "I hate what the Forest Service does, but I have to say that when I worked for them I felt as if I was part of a family, part of a team. In the environmental organizations I have worked for since, I have never had that feeling."

During discussions with younger employees of nonprofit organizations about the effect of management on employee morale, it became clear that some have never experienced "good" management and were fascinated by the whole concept.

While it is difficult to generalize about thousands of groups of different sizes and missions, observers and directors of nonprofit organizations agree that many have management problems that impede their effectiveness. From national organizations like United Way to local social-service organizations, conflicts over goals, funding, and leadership are apparent. Even several major meditation centers have undergone agonizing internal management shakeouts caused by conflict between the members and the directors.

Nonprofit and social-change organizations are not the only organizations under stress. Ross Perot's recent acrimonious split with General Motors was caused in part by his aggressive criticism of its president for failure to communicate with employees. Apple Computer, which many held to be a model of organizational creativity, expelled its founder for alleged lack of management skills. A recent survey of 120 senior women executives found that 91 percent had had at least one bad boss in their career.

Workers in America have many problems. They get significantly less vacation time than most European workers. Government regulations to protect workers, the public, and the environment have been gutted in recent years. The nation has no national health-care program. Few strong unions exist to successfully bargain on behalf of workers. Workers are held as hostages by the multinational corporations. Whenever needed changes to protect the environment, provide full employment, or deal with social ills are proposed, the mere recitation of the nineties mantra "jobs, jobs, jobs" seems sufficient to drive would-be reformers from the

field in total rout. In an article in *INC* (April 1992), Paul Hawken asked, "Why is it that work is so hellish for the majority of Americans?"

A good candidate for patron saint of America's workers might be Benedict Arnold. The English generals thought he was America's best fighting general, and that without him America would have lost the Revolution. But the generals who supervised Arnold were bitterly jealous of his successes and routinely court-martialed him after his major victories — one of which he won after he broke out of jail, raced to the front of a battle in which the Americans were being routed, rallied the troops, and saved the day. Finally Arnold got fed up and turned coat so he could work under managers who appreciated him (and paid better, too).

THE MANAGEMENT OF ORGANIZATIONS

The day-to-day operation of any organization, no matter the size or purpose, includes certain management tasks:

- Work areas must be acquired, laid out and assigned.
- Someone must decide what work is to be done, who is to do it, and what the workflow will be.
- The quality and timeliness of work products must be overseen.
- Bringing human beings together inevitably means that all the complex idiosyncrasies of people will surface. Whether negotiating a formal union contract or congratulating a staff member on a new baby, managers must deal with issues that arise simply because they are dealing with people.
- Operating an organization requires deciding who to hire, what to pay them, and how to provide employee benefits.

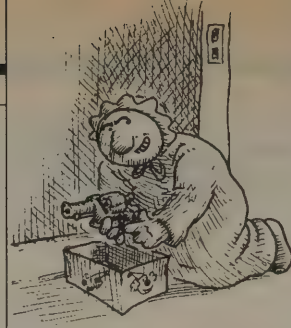
The mundane details of managing an organization may not be as interesting as giving an interview to the *New York Times*, or having a

Rules For People Who Work For Insecure Egotistical Jerks

These rules were learned the hard way. You can follow them while you spend your free time looking for another job:

- If you don't have a boss, or if your boss doesn't tell you what to do, figure out what a good boss (if you had one) would tell you to do, and then do that.
- Never reveal your true opinion about your boss's management style, even if you are asked under situations which might lead you to believe that honest feedback is really sought.
- Never overestimate the intelligence, knowledge, or integrity of your supervisors.
- When under interrogation, ask yourself, "Is my boss gathering information or ammunition?"
- If you have an issue so important that you must bring it to the top person in the organization, approach that person directly. Intermediaries grind their own axes coming and going.
- If your written appraisal is poor, your boss thinks you

senator ask your opinion on some upcoming legislation. But truly creative managers remember that God is in the details. Chaos and disorganization masquerading as freedom may create diversions that allow the manipulation of others. Some managers equate that with power: it is not. The vicissitudes of life and the laws of entropy create enough disorganization, without managers playing "pile-on."



work is poor, no matter what is said.

- Don't allow yourself to be physically segregated from the rest of the staff.
- Once a day, every day, do someone a favor.
- The core goal of junk-bosses is to surround themselves with subordinates who will ratify their self-image.
- When you shoot at a king don't merely wound him.
- Choose your next job on the basis of which job has a supervisor who can teach you the most.
- Carefully observe when your boss is talking to a stranger about subjects that you understand, but the stranger doesn't. This will teach you useful body-language clues that accompany dissembling and lying. Then you will know when they are being used on you.
- Beware jobs that keep you too long on an adrenaline rush.
- Always remember that life is too important to take seriously.

UNIQUE PROBLEMS OF NONPROFIT ORGANIZATIONS

In addition to the stresses common to all workers, nonprofit organizations often have problems not shared by large "for-profit" operations: insurmountably burdensome tasks, uncertain funding, inadequate pay scales, "voluntary" overtime, poor employee benefits, inadequate

staffing, inadequate space, and substandard equipment. Ongoing funding is often based on gifts and grants, creating a life "on the dole." Certainly, the daunting task of integrating volunteer and paid staff into daily operations is one not faced by most government or profitmaking operations. These problems are endemic to social-change work, and those choosing to work for nonprofit organizations accept these conditions in return for doing work that is socially important.

But the smaller nonprofit organizations suffer from unique problems, due to a paucity of management resources compared to large organizations, parlayed with managers who often have little management experience. Large nonprofit organizations like the Girl Scouts and national religious organizations have management resources comparable to large for-profit organizations. In the case of the Scouts, they also have institutional wisdom built up over time, based on many successes and many problems solved. Most small grassroots organizations have neither resources nor history to draw on.

Large profitmaking and government organizations usually have formal staff functions for management tasks, which in turn have subspecialties — purchasing, recruitment, systems acquisition, employee counseling. Each of these subspecialties has its own supporting professional organizations with professional certifications and accreditations, journals, conferences, and ongoing training programs. Large organizations may have an entire professional staff exclusively devoted to managing bulk-mail operations; a nonprofit or social-change organization may have a volunteer who, once a year, engages in a brief conversation with a misinformed clerk at the local post office.

One small volunteer environmental group in Oregon wasted 20 percent of their overall budget for five years because the local postmaster misinformed them about

*Managing people
is like writing rhymed
poetry: people need
the widest possible
freedom within a
disciplined structure.*

their eligibility for bulk-mail privileges, and charged them the full first-class rates to mail their newsletter — which could have been sent out at a fraction of the cost with a nonprofit bulk-mail permit.

Managers in large organizations not only have technical support, but their personal career paths usually include assignments and training in various management specialties at several supervisory levels. Management development staffs examine and evaluate the strengths and weaknesses of individual managers from early in their careers. Individualized career development and training programs are devised for each manager. Managers often go through formal training programs with mentoring by senior managers who formally evaluate the candidates' performance, strengths, and weaknesses. People who aspire to management careers are expected to attend the many training programs offered by colleges and universities. A large organization would no sooner put a person without formal training into a position of managing others than it would make a staff accountant the pilot of the company airplane.

Big organizations can be hellish places to work, but most have a variety of mechanisms to detect, prevent, and correct the effects of poor management. Personnel practices are formalized and

monitored. Formal employee grievance systems identify difficult managers early. Unions and their shop stewards in the work units act as a check on poor management practices. Large organizations have many departments, so employees can often transfer away from unsatisfactory work areas. Personnel departments have employee-counseling programs where employees can get advice and talk out their problems in confidence. Managers usually have other experienced managers nearby to whom they can go for advice.

The managers of nonprofit organizations not only arrive in management positions with little prior supervisory experience, but typically have little in the way of support systems. Often they are selected for skills unrelated to managing others (typically: fundraising, law, publicity, political activism, science, or writing).

DYSFUNCTIONAL ORGANIZATIONS

When a staff member's work atmosphere is harmonious and constructive it has a positive effect on a wide circle of family and friends. Conversely, poor or insensitive supervision can have adverse lifetime impacts on its victims. Staff members in dysfunctional organizations may find it impossible to figure out whether their problems arise from a society in decline, problems intrinsic to poorly funded organizations, impossible tasks, ineffective management and supervision, or their own shortcomings and inexperience.

In one instance, a highly capable and popular employee of a social-change organization spent months organizing and presiding over a successful conference that brought national recognition for the executive director. On the Monday morning following the conference, she was called into his office and fired.

Poorly managed organizations exhibit some or all of certain basic

symptoms. Such organizations may lurch from crisis to crisis. Projects frequently change scope and direction in midstream. Staff members may have a lot of personal problems: marital problems, overeating, sickness. Managers are often unhappy with their whole staff. Visitors to the office may sense a sullenness in staff members. Receptionists don't have time to be friendly.

A manager oblivious to the social complexities of an office full of people is a lot like the manager of a logging company who is oblivious to the biological complexity of a forest he is logging. The seemingly insignificant day-to-day decisions of either can have profound long-term implications. A decision, for example, about where to place the desk of a new employee may affect the course of that person's whole life. It determines who s/he will see and talk to in the course of a day, how private his/her work life will be, and how much ergonomic stress (such as artificial light or the noise of photocopiers) s/he will be subjected to. This will reverberate through the whole social ecosystem just as surely as a decision about where, when, and how to conduct logging reverberates through the physical ecosystem.

A person who has audited hundreds of offices told me that he could go in the front door of an office, walk through it without looking right or left, exit the back door and write a report on the management of the office. An experienced forest ecologist can walk into a natural setting and read what is happening at a glance; so can a professional manager. The style of a manager impresses itself on the look and feel of the whole operation.

Every organization has to deal with the avalanche of information that pours into it, and integrate this information into the assignment and monitoring of ongoing work. Nothing reveals the vision of an organization as well as the way its executives manage information and time. People never

have time to do all that they ought to do, but they usually have time to do what they really want to do. A manager who doesn't consistently answer mail and phone calls sends an important message to the staff. One sure sign that an organization has lost control is unanswered mail and unreturned phone calls.

A few years ago, an environmental organization sent people to sit on a board to review and vote on

proposed federal timber sales in or near Spotted Owl habitat. One of the board members asked the regional headquarters of his environmental organization for guidance. The person he talked to was far away, knew nothing of the details of the operation of the board, and was busy, so he told the board member to just go along with the process and try to cooperate.

When the voting began on the afternoon of the first day, the

How To Identify Dysfunctional Organizations



- Physical space is untidy and disorganized.
- Desks are cluttered and messy.
- Eating areas are posted with warnings, threats, and admonitions.
- Logs are out of date or not kept at all.
- File cabinets are not purged of obsolete material.
- Chronic facilities problems (to do with heating, cooling, noise, air conditioning, or air quality) exist.
- Staff members' effectiveness is impeded by inappropriate or poorly maintained office tools — computers, phone systems, photocopiers.
- There are chronic staff complaints about allocation and quality of space and equipment.
- Management followup and oversight may be lacking, or may take the form of nitpicking.
- Personnel turnover is high.
- Staff members complain

- about not being informed or being left out of important decisions.
- People are unduly concerned about who gets credit or blame.
- The office is divided with interoffice feuds, jealousy, or bickering.
- The organization itself has continual conflicts with other organizations.
- Managers are overworked while other staff members have little to do.
- Important documents frequently get lost or misplaced.
- Phone calls are not returned, mail languishes unanswered.
- Staff members have no idea what management thinks of their performance.
- Terminations occur at short notice or come as complete surprises.
- Certain staff members are singled out as favorites.
- Staff members put signs on their desks like "It is hard to soar with eagles when you work with vultures."

other environmental members on the board realized to their horror that this member was consistently voting with the timber industry against the environmentalists. When asked on a break what in the world he was doing, he said that he had been instructed to go along with the process and not cause problems. By the end of the day, seventeen million board feet of timber had been approved for logging in split decisions that the environmental community lost by a one-vote margin, caused by that one phone call.

RELATIONS BETWEEN MANAGEMENT AND STAFF

One person knowledgeable about social-change organizations recounted the story of a director of a nonprofit, a lawyer, who routinely drove out the lawyers working for him because he was unable to delegate even simple legal responsibilities to others.

Another professional in a national environmental organization told me that although his organization had only 200 people and he had worked there for six months, he had never talked to the executive director. When I mentioned this later to another professional in a different environmental organization, he said the same thing.

Unlike biology or plumbing, where the need for training and apprenticeship is taken for granted, many people assume that the ability to manage people is innate. Perhaps for a few it is, but for most of us it is a trade just like any other, and must be learned by training and coaching. Absent this preparation, most people revert to the only supervisory models in their experience — their parents. Much of what staff members resent in their managers is merely the manifestation of adult supervisors treating staff members as their parents, spouses, or children.

While researching this article, I heard (from employees in both nonprofit and for-profit organiza-

*"Charity" in every
sense of the word must
begin at home; for
workaholics to whom
"home" seems to have
become the office, it
must begin there.*

tions) several variations of one particular story: A manager sits at his/her desk and keeps writing, while a staff member stands in front of the desk unacknowledged. This type of manager dominates and intimidates perceived subordinates while fawning over perceived superiors. This might be called the "lick what's up, kick what's down" syndrome. Certainly this is unacceptable behavior in any organization, but it is particularly egregious in a social-change organization.

The leader of an organization is not necessarily the smartest, the most capable, or the best person on the staff. The leader's role is to bring out the best performance the team is capable of producing. This requires that the leader bring information and direction to the team, represent its interests to the outside world, and be very attentive to the needs of the team members and the dynamics of their interactions.

People need feedback and recognition, and will go to great lengths to get it. In the social-change sector, people often measure their personal worth by how they are able to help others and by the changes they are able to bring about in the world around them. When managers ignore intangibles such as praise, access, status, feedback, and self-esteem, em-

ployees can be forced into negative, unproductive loops.

Julius Caesar was so beloved of his soldiers that when he ran out of money for his army, his troops pooled their money and gave it to him. Why? He always put the welfare of his troops first. Once he was caught in the woods in the rain and there was only one hut. He gave it to a sick soldier and slept in the rain on the ground. He would always personally do the most dangerous jobs, like reconnoitering the enemy camps. If loyalty of staff to management is a concern, there is no better guide than the management style of Julius Caesar.

GOOD MANAGEMENT

In the late 1930s and early 1940s, the Roosevelt administration launched the New Deal and, because of the depressed labor market, brought into government an unusually well-educated and liberal-minded group of people who were passionately devoted to reforming society through the effective implementation of social-change programs. By the early 1970s, when they retired, some of these people had reached the highest levels of government. I was fortunate to know some of these managers in the closing years of their careers.

In the two decades since these managers left, their organizations have deteriorated along with the rest of the federal government. Nevertheless, the essence of what they believed, taught, and tried to practice is still valid for any organization:

- No organizational crisis ever justifies treating people without respect.
- Managing people is like writing rhymed poetry: people need the widest possible freedom within a disciplined structure.
- An organization must have explicit values and principles, and every decision the organization makes must be judged against them.

- An organization is a hologram; the quality and ethics of the top managers will be reflected in every aspect of its operations.

- To manage is to often make mistakes, so managers must have staff people who can "speak truth to power."

In January 1968, on the first day of my assignment to Karl, he called me in to get acquainted. About ten minutes into the visit Karl's secretary stuck her head into the office and said that Bob, the legendary head of the whole organization, was on the phone and wanted to speak to him. Karl

said "Tell Bob I'll call him back later." A few months later I was having lunch with Karl and asked him why he had not taken the call. He relayed this story:

Some 25 years earlier, when on his first assignment as a regional junior staff assistant, he had been called in for a visit with the regional administrator, a woman who was a powerful force in the Democratic party, a personal friend of President Roosevelt and a former ambassador to Great Britain. During the visit an aide informed the administrator that the Queen of England was on the

phone on a transatlantic call. She told the secretary "Tell the Queen I'll call her back later." Then she turned to Karl and said "Excuse me for the interruption." That incident made such an impression on Karl that from that day forward he made it a policy not to interrupt conversations with subordinates.

SUMMARY

The purpose of social-change organizations is to make the world a better place. Their legal and historical roots spring from

Books to Help You Manage

BY JIM BRITELL AND MARTHA WEAVER-BRITELL

Spending the day cooped up in an office is not our idea of life, but we've done it when necessary. Like any other activity, over the years people have developed some ideas and rules about how to do it. The six books on the following pages can help; but learning to work in or manage an office from a book is a lot like learning to ride a horse from a book — painful and slow.

Organizational Behavior

There are a lot of popular paperback books on management that have one idea between two covers. This book has all those ideas, critiques of the ideas, and more. It is literally a textbook of management theories with an overview of the underlying psychology. The material is presented in a very accessible fashion, a far cry from the textbooks of my college days. I wish I had had this book when I was supervising people (and so would they).

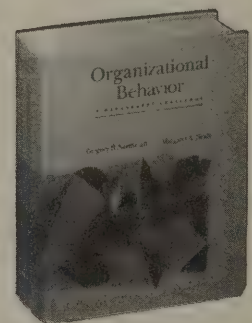
■ *NCR's Corporate Culture Crosses International Boundaries*

It was August 1945, and S. C. Allyn, chairman of the board of National Cash Register Corporation (NCR), was one of the first allied civilians to enter Germany at the end of the war. He had gone to find out what had happened to an NCR factory, built just before the war, that had been promptly confiscated by the German military command and put to work on the war effort. He arrived via military plane and traveled through burned-out buildings, rubble, and

utter desolation until he reached what was left of the factory. Picking his way through bricks, cement, and fallen timbers, Allyn came upon two NCR employees whom he hadn't seen for six years. Their clothes were torn and their faces grimy and blackened by smoke, but they were busy clearing out the rubble. As he came closer, one of the men looked up and said, "We knew you'd come!" Allyn joined them in their work, and together the three men began cleaning out the debris and rebuilding the factory. The company had even survived the ravages of war.

A few days later, as the clearing continued, Allyn and his coworkers were startled as an American tank rumbled up to the site. A grinning GI was at its helm. "Hi," he said. "I'm NCR, Omaha. Did you guys make your quota this month?" Allyn and the GI embraced each other. The war may have devastated everything around them, but NCR's hard-driving, sales-oriented culture was still intact.

Source: T. Deal/A. Kennedy, *Corporate Cultures*, © 1982, Addison-Wesley Publishing Co., Inc., Reading, Massachusetts, p. 3. Re-



Organizational Behavior (A Management Challenge)

Greg Northcraft and Margaret Neale, 1990; 878 pp.

\$51.25 (\$55.35 postpaid) from HBJ College Publishers/Order Processing, 6277 Sea Harbor Drive, Orlando, FL 32887; 800/321-5068

printed with permission of the publisher.

■ In any organization there are really two organizations: (1) the formal organization, consisting of the formal reporting relationships, rules, and procedures, and (2) the informal organization, consisting of what really goes on in the organization, including beliefs and social relationships.

Source: R. J. Selfridge and S. L. Sokolik, "A Comprehensive View of Organizational Development," *MSU Business Topics* (1975): 47.

a tradition of charity, giving, education, helping, and sharing. The profitmaking world seeks to domesticate, simplify, and commodify the world, to treat people as fungible objects so they will be more efficient consumers. If social-change organizations treat employees as disposable objects, is this any different than the for-profits that view the whole world as simply a commodity to be "parted out?"

Many people work for social-change organizations because they empathize with the plight of other beings; this emotional

response should be respected and encouraged. Our environmental and political problems are due in large part to its absence in too many people. But "charity" in every sense of the word must begin at home; for workaholics to whom "home" seems to have become the office, it must begin there.

While there certainly are many innocent victims in this world, most employees of public-interest organizations cannot claim to be among them. We create our own reality, not through some mystical means, but through our every

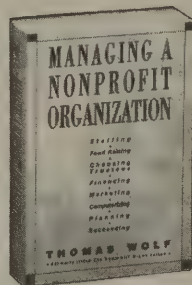
perception and through each small decision and action. Managers and employees in social-change organizations need to set an example for the rest of society by taking care of themselves as well as others. We cannot expect to really change the world unless we can change ourselves. Of course, we can't wait until we are perfect — we must all just keep trying. I once worked in an office with many other professionals. One busy day we were squabbling over work assignments. Molly, the receptionist, walked over, eyed all of us sternly and said, "Kids, please, play nice." ☘

Managing A Nonprofit Organization

Written by a consultant to nonprofit organizations, this book addresses management issues of importance to nonprofits' managers and trustees. A large part is devoted to budgeting and fundraising. Another major topic is the proper functioning of a board of directors — a particularly important issue in nonprofits. The book also covers other basic issues of organizational management. Most chapters have a checklist at the end, in the form of questions that can be used to assess an organization's performance in a given area.

Checklist Questions for Chapter 4

1. Does your organization have an organization chart that clearly and unambiguously shows chains of employee authority and accountability?
2. Are there job descriptions for all employees in your organization? Are they up-to-date?
3. Are compensation scales realistic and fair in your organization? Are employee benefits comparable to those in other nonprofit organizations of similar size? If salaries and benefits are not adequate, is there a plan to address this issue?
4. Has your organization clearly documented its hiring and pay procedures? Is there a formal evaluation procedure for every employee in your organization? Have grievance and termination procedures been developed?
5. Has your organization developed conflict-of-interest policies for employees?



Managing a Nonprofit Organization

Thomas Wolf,
1984, 1990; 310 pp.
\$13 (\$16 postpaid) from
Simon & Schuster, 200 Old
Tappan Road, Old Tappan,
NJ 07675; 201/767-5937
(or Whole Earth Access)

6. Does your organization have a personnel manual? Is it complete and up-to-date?

Given the fact that reporting and authority lines must be respected, they must be set up carefully. Supervisors must be capable of supervision; employees should not be expected to report to people who are incompetent. In addition, multiple supervisors should be avoided whenever possible. If an employee must report to two bosses and the two do not agree, this puts the employee in an awkward position. In the orga-



nization chart in figure 4.1, for example, the third secretary carries out work for four people — the director of programs and the three coordinators. However, the principal reporting line is to the director of programs. This means that in instances where it is unclear whose work needs to get done, the secretary can ask the director of programs to establish priorities.

Office Administration Handbook

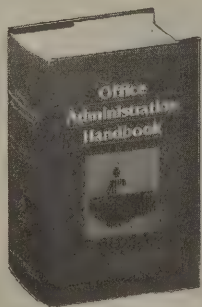
It's ass-backwards to worry about the latest motivational techniques while the toilets in your office building are not kept clean and papers are piling up because there is no place left to file them. These might be symptoms of a dysfunctional organization, or they might just be signs that management doesn't know the basics of running an office.

This book covers a lot of the nuts and bolts of office management, from hiring employees and filing alphabetically to the uses of bulletin boards (the old-fashioned kind). Where else can you find the General Services Administration standards for cleaning office buildings and a summary of popular motivational theories in the same volume?

[note to editor: Jim loves this book. I think it is sexist and fascist, but covers some important stuff. — Martha]

[note-to-editor rebuttal: Martha thinks that everything I like is sexist and fascist. If I had never read Uncle Remus, I would never have found this proverb: "Watch out w'en you'er gittin' all you want. Fattenin' hogs ain't in luck." And Hitler had interesting things to say about architecture and the social implications of film ratings. —Jim]

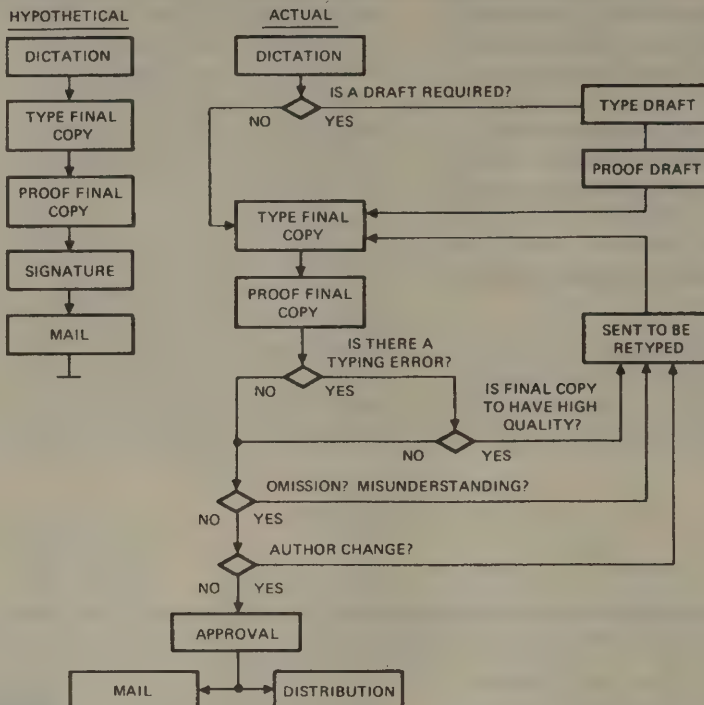
It is hard to measure the cost of noise in an office in dollars, but the loss is probably much greater than management realizes. Before moving into its new building some years ago, the Aetna Life Insurance Company made a careful study of the effect of noise on office production. After it had moved into its new quarters the walls and ceilings of which were noiseproofed (acoustically treated), the study was con-



Office Administration Handbook

(6th Edition). Clark Fetridge and Robert Minor, Editors.
1984; 974 pp.

\$49.95 (\$53.95 postpaid) from Dartnell Corp., 4660 N. Ravenswood Avenue, Chicago, IL 60640



Actual usable production time of a typist is 9 to 14 words per minute, as depicted in the comparison of a hypothetical versus actual dictation/typing cycle; this shows the fallacy of the usual criterion of 50 to 75 wpm as "acceptable." Courtesy, Raytheon

tinued for several years. The results were as follows:

1. The noise level was reduced 14.5%.
2. Employee efficiency was increased 8.8%.
3. Errors were reduced 29% for typists,

- and 52% for office machine operators.
4. Employee turnover was decreased 47%.
5. Absences were decreased 37.5%.
6. Personnel requirements were lowered about 10%.

Your Rights in the Workplace

Nolo Press again provides a source of do-it-yourself legal information, this time regarding the workplace. It's surprising how few rights workers really have. But if you think you're not being treated fairly, this book tells you what you can do about it and even has a chapter on how to pick a lawyer.

Veronica, a municipal bond agent with a bank in New York City, traveled to Los Angeles on business with Jeremy, the bank's vice president in charge of municipal finance. As they checked into their hotel, Jeremy instructed Veronica to meet with him to coordinate the details of their presentation to clients scheduled for early the next morning.

When Veronica arrived at Jeremy's suite about an hour later, she was dismayed to see a half-empty bottle of vodka and a copy of a sexually explicit magazine, opened to

the centerfold, on his desk. Jeremy came up to her from behind, picked her up and carried her — despite her protests — into the bedroom. Dropping her onto the bed, he positioned himself on top of her.

Throughout the ordeal, Veronica repeatedly warned Jeremy to stop, that she didn't want to have sex with him. But Jeremy countered her protests with intimidations and insults such as "Why do you think I approved your promotion last month?" and "All the senior executives are waiting to hear what you're like in bed." And most bluntly "You'll do this if you want to keep your job."

Eventually, Jeremy overwhelmed Veronica and raped her. No deadly weapon or overt violence had been used, but Veronica was able to have Jeremy prosecuted criminally for rape because California law forbids using duress to force a person into sexual intercourse.

The Addictive Organization

One of the points this book makes is that social-change organizations attract as employees co-dependents who want to fix the world. Unfortunately, these people replicate their ills within the organizations.

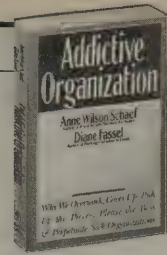
Anne Wilson Schaefer and Diane Fassel share what they have learned as recovering co-dependents and organizational consultants about the disease of addiction in all kinds of organizations. They are true believers who "name" addiction and co-dependency everywhere. In the past there was original sin to explain the problems of the world; now there is addiction. The solution to both is the same — to surrender one's will and life to God.

We experienced the pervasiveness of co-dependence when we were conducting a workshop for a group of secretaries at a medical supply company; the women (there were no male secretaries in this company) were already self-identified co-dependents, so there was not the usual problem of denial in this group. However, some of the secretaries felt it was all right to be "nice" all the time. They often said, "No one likes a bitchy woman." At one point in the workshop, we broke into smaller groups of about twelve each, and various members of our team acted as facilitators in the smaller groups.

In one group, the facilitator noticed that the webbing in her chair was stretched and the chair cushion was slowly moving closer

and closer to the floor. Jokingly, the facilitator mentioned this fact to the group. She said, "I seem to be sinking into the floor." Immediately, twelve women jumped out of their chairs and began scurrying around the room — some ran into the hallway in search of a replacement chair; others dashed to the facilitator to help her; and others offered their chairs. At that point, the facilitator asked everyone to stop and take a look at what she was doing. The defective chair had just provided a good lesson in co-dependent behavior.

Typical of co-dependents, these women had made several assumptions. They had not listened to the facilitator's actual words; they had decided what the facilitator really wanted: a chair. Even those who heard what she said jumped ahead and made an assumption about what was good for her. Being good co-dependents, they of course knew what the facilitator needed before she did. In the same fashion, these women leaped into action doing what they supposed would please the facilitator (co-



The Addictive Organization

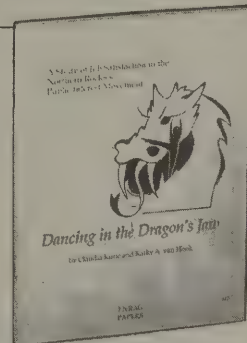
Anne Wilson Schaefer and Diane Fassel, 1990; 232 pp.

\$8 (\$10.75 postpaid) from HarperCollins Publishers/Direct Mail, P. O. Box 588, Dunmore, PA 18512; 800/331-3761 (or Whole Earth Access)

dependents like to be liked; they search for ways to please). Throughout all of this activity, the needs of the facilitator became irrelevant; in fact, no one even thought to inquire whether she wanted a chair or was uncomfortable. Under the guise of being "nice," "unselfish," and "considerate of others" they had made the person they intended to serve invisible.

Dancing in the Dragon's Jaw

This report is based on a survey of past and current employees who worked for Idaho, Montana, and Wyoming public-interest groups from 1980 to 1987. It analyzes job-satisfaction issues and proposes changes to make public-interest jobs more satisfactory. While the study was limited to the northern Rockies, the findings are applicable to public-interest groups anywhere.



"The public interest sector is the cutting edge. I'm happy that I've had the opportunity to work as staff within the public sector. I love what I'm doing, who I work for and what I stand for, but I always feel like I'm dancing in the dragon's jaw."

—a Northern Rockies public interest worker

Peggy wakes up most mornings excited about the day ahead of her, thinking about her job as an organizer for a low-income organization. Having once been a welfare mother, she has first-hand knowledge of the issues and people she works for. After feeling trapped for years, Peggy feels alive and proud that she is fighting to make things better.

Peggy has grown in the last three years she has had this job. She has been given the freedom to hone her innate organizing skills and learn new skills in lobbying, fundraising, and public relations. Her co-

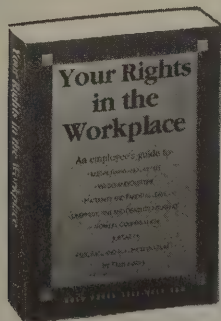
Dancing in the Dragon's Jaw

Claudia Kuric and Kathy A. van Hook, 1989; 45 pp.

\$10 (\$11.50 postpaid) from Northern Rockies Action Group, 9 Placer, Helena, MT 59601

workers are her support group, encouraging her and challenging her to grow.

Even though Peggy loves her job, lately she's been thinking she needs to quit. Her car broke down again and her eldest son needs glasses. Whenever she works overtime, usually one or two evenings a week, it costs her money because she has to pay for extra childcare. Peggy can't make ends meet on \$220 a week. Although she hates the thought of it, Peggy is going to apply for a truck driving job with a local delivery service where she can make twice as much money.



Your Rights in the Workplace

Dan Lacey, 1991; 350 pp.

\$15.95 (\$19.95 postpaid) from Nolo Press, 950 Parker Street, Berkeley, CA 94710; 800/992-6656 or 510/549-1976 (or Whole Earth Access)



Rameshwar Das

SEVA: The Eyes Have It



BY WAVY GRAVY

IT WAS RECENTLY BROUGHT to my attention that a mainstream medical journal ran an article suggesting that service to humanity could be good for your health.

Fancy that!

I can just imagine dozens of doctors at this very moment uttering phrases like, "You're looking a little peaked, Mr. Brown. Walk three old ladies across the street and call me in the morning."

... and it works!

This is not exactly earthshaking news for yours truly. Twenty years ago I battled my way out of severe postsurgical depression by serving as a clown at the local children's hospital. After several months of clowning for kids I began to experience a positive high well beyond anything I had ever achieved from a pharmaceutical cabinet. This effect was further enhanced by my involvement in organizing musical benefits for various causes. I was extremely effective at this endeavor because a.) I knew a whole lot of musicians and b.) they seemed to trust me. Personally I had a major problem with the dispersal of funds after the gig. I seldom knew if the money I had laboriously helped to raise reached its intended

If you could cross Gandhi and Groucho, Gravy is what you'd get.

Wavy Gravy has covered the persona of Hugh Romney indefatigably ever since B. B. King put the name on him, years ago. The name and the person have transformed over the years into a weird kind of American hero, a master of humor yoga, veteran political clown and servant of the afflicted — one of the people most qualified to help all of us deal with the late twentieth century. Listen to him. There's something serious in the silliness.

*If you read our advance excerpts from Wavy Gravy's laff-a-minute political autobiography a year ago ("What Makes Wavy Run," WER #70), you know why he's the only person I could in good conscience elect to the Presidency of the Whole Wide World. If you want to have a spiritual experience that makes you giggle and gives you good ideas about what to do with your life to help others, go out and get a copy of his book, *Something Good For a Change* (reviewed by Ram Dass, p. 99), fresh-minted from St. Martin's Press.*

—Howard Rheingold

The gift of light. Seva volunteers work to prevent and cure blindness in Asia. A cataract operation in a mobile eye camp takes about ten minutes and costs about as much as a movie ticket.



destination or ended up in a black hole somewhere. This was a real dilemma in my life.

Then along came SEVA! Seva is a Sanskrit word meaning service. It is also the name of the foundation I helped to found some fourteen years ago with a lot of help from my friends . . . many of whom were with WHO (the World Health Organization) and had worked as doctors and epidemiologists on the successful campaign for the eradication of smallpox in Southeast Asia. Others had roots in rock and roll and new-age spiritual communities. Every religion and most political and economic strata were well represented. Our common denominator was the desire to serve. Our first project was to work with the govern-

ment of Nepal in a national program for the prevention and control of blindness.

Why blindness? More than 20 million people in the world today are blind from conditions that are preventable or curable. A cataract operation in a mobile eye camp takes about ten minutes and costs about the price of a movie with a few friends.

For the last fourteen years I have functioned as a FUNdraiser for Seva in the field of special events like Sing Out for Sight (with folksingers at Carnegie Hall) to The Third Eyeball (with The Band and the Grateful Dead, outside Toronto).

This year we produced Blues Against Blindness,

Compassion In Action

*Compassion might be the most powerful tool and idea humans have at our disposal — a little bit goes a long way. Here are some people who speak for compassion as guilt-free high, a form of ecstasy that still feels good the next morning. The authors start with the stories of their own quests to discover who they are and show how those inward journeys turned into decades of working in the outer world on how to help others who are suffering. **Compassion in Action** is about the connections between those questions of identity and action, a how-to guide to doing something about suffering today.*

This isn't a theoretical spiritual book. Action is part of the title because when you acknowledge the existence of suffering, you have to decide what to do. The authors show how bodhisattva's vow — "sentient beings are numberless and I vow to save them" — can be both a way of life and a state of mind. The bodhisattva and Jesus stories both convey the message that consciousness and conscience are connected, that helping other people is a high spiritual calling.

Ram Dass writes of the personal awakenings of his heart and his experiences in pursuit of compassion. Here's Richard Alpert, the man who turned on to LSD at Harvard with Timothy Leary thirty years ago, who found his guru in India twenty years ago and became Ram Dass, who has been working with sick and dying people for the past decade. Who could have predicted that Richard

Alpert would end up serving the sick and dying?

Co-author Mirabai Bush offers her own realistic, hands-on recommendations for ways of stepping onto (or continuing on) the path of service. Both former chairpeople of Seva Foundation, an organization devoted to combatting blindness in Nepal and elsewhere (see Wavy Gravy's piece), the authors give us more than the "why" of service. They show us how to go about it, in various ways, illustrated with tales of how people they know created successful enterprises devoted to compassion. The authors also convey a compelling sense of how it feels to try to serve others in a conscious manner. For readers who want to learn more or become active practitioners of compassionate action, the book includes an extensive, annotated bibliography of other books and resources, including access information about organizations that can use our help.

Turn on, tune in, help your fellow sentient beings. —Howard Rheingold

■ *Everyone in Seva would say that it is good that I didn't take myself seriously, because we have a "thing" about that word. In fact, Wavy Gravy introduced a pair of Groucho Marx-like glasses to the board meetings. Anyone who uses the word serious is required to stop and put on the funny glasses. This ritual serves, as Wavy pointed out, to keep us from taking ourselves too seriously, a real danger in service organizations such as ours. As we deal with the horrendous sufferings in the world, Wavy often*

needs to remind us that "if you don't have a sense of humor, it just isn't funny."

As chairperson I visited our program in Nepal. There were a number of ongoing projects that required some board member involvement, and that year I was chosen to go. I had been thrown out of Harvard in 1963, and now, twenty years later, the act of putting on a blue blazer and striped tie and representing an institution in the official world was bound to reawaken old habits. I would have to be Dr. Dass.

In Nepal I found it necessary to visit a government official to bargain for some relaxation of bureaucratic red tape. In return I was authorized to sweeten the pot somewhat. So we met: he with his entourage, me with mine. We had tea and made small talk prior to getting down to business. I was very uptight because I realized that I had to be an astute bargainer, and my tie, literally and symbolically, felt too tight. I was back into my old mode of twenty years ago, seeing the man as a bureaucratic object to be manipulated for my own ends. My counterpart, by contrast, was doing his best to understand a chairperson of an American foundation (and in his mind all American foundations were like wish-granting trees or geese that lay golden eggs), who was called Ram Dass and was holding a mala (beads).

Just before we were to begin the serious part of the meeting, I looked up in my nervous state and found him looking at me. Our eyes met and held. There, behind the government ministerial role, was another being, just like me. At that moment I felt great joy as his gaze released me from imprisonment in my role as chairperson. We were two beings about to enter into a for-



Compassion as Clownmanship: Wavy Gravy, master of doing good by having fun.

mal, stately, and highly ritualistic dance together, or perhaps we were about to start a game of Monopoly, and Government Minister was the top hat piece; Chairperson was the thimble or iron.

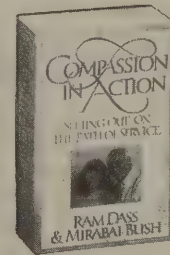
In that situation, my government friend, as a truly spiritual Easterner, was not caught in his role. And his seeing behind his role allowed me to stop being entrapped in my own. So often in subsequent years I have remembered that instant, and the memory of it awakens me again to the entrapment of the moment and helps me to dance free. And often now I find myself in the role of the "eyes," inviting another being, in the midst of a seductive drama, to come out and play.

Visiting Guatemala to work on our projects there taught me other valuable lessons about compassion. We were visiting the villages where Seva's goat and sheep projects were under way. These communities are composed mostly of women, young children, and a very few men. The women had watched their husbands, sons, and parents killed before their eyes. Later those who did not cross to Mexico returned to their villages, in which buildings had been ransacked and burned, animals killed, crops destroyed. There was nothing left, and still they held on. They reminded me of the tiny blue flowers one finds growing in rock crevices high above the tree line, seemingly out of the rock itself. They are buffeted by winds, nourished by so little, and still they hang on.

Seva, in alliance with a Guatemalan NGO, had provided goats and sheep to give these women and their children, who were not really strong enough to replace the men at growing corn, their source of food and livelihood. And when we visited villages to which the animals had been given only a few short years before, we found that the project was working. The children were healthy from the goat milk, there was meat and a little money from the sale of baby goats and sheep. What we hadn't expected, however, was that these bumptious animals, which the women and older children held on ropes to display to us, brought them more than physical survival. They brought laughter and joy.

How different these villages were from the ones we visited the next day, villages that hadn't yet begun a project, where there was still nothing . . . nothing. The people met with us and explained that they had no seed, no hoes, no water; all they had was their will to work if we would only loan them enough to get started.

There were thirteen such villages, and, no matter how we tried to juggle the Seva funds, there would be enough to help only four of them in the next fiscal year. We explained this to the Mayans. Our inability to help weighed heavily on us, because we could see how many of these people would die as a result. I don't recall ever experiencing so powerfully that link between funds raised at lectures and benefits and the preservation of life itself.



Compassion in Action

(Setting Out on the Path of Service)

Ram Dass and Mirabai Bush, 1992; 299 pp.

\$11 (\$12.50 postpaid); audiocassette version **\$16** (\$17.50 postpaid) from Hanuman Foundation Tape Library, 524 San Anselmo Avenue #203, San Anselmo, CA 94960; 800/248-1008. The book is also available from Whole Earth Access.

The Mayans' response to our offer was an interesting one. They said that the funds we could provide to the four villages they would divide among the thirteen. We weren't happy, because so little funding per village might not be sufficient to assure life for everyone, and we told them that. Their reply remains with me now. "From our holy book, the *Popul Vuh*, we have learned that when you are walking along together and one person falls, you help that person up, and then everyone walks just a little bit slower." Their words spoke of what a real sense of family is about. We went back to North America and raised the rest of the money.

which raised over sixty thousand dollars for our projects in Nepal and India. We are building an eye hospital in Lumbini near Buddha's birthplace, and helping to plan The Aravind Eye Institute, which will train and inspire blindness-prevention workers from around the world.

All this requires piles of green energy. Photos of dead presidents. Cash . . . checks . . . money orders, credit cards, foodstamps, fillings, or good vibes. Send to:

Seva Foundation
8 North San Pedro Road
San Rafael, CA 94903

I know exactly where it goes, too!
The eyes have it. 🙏



This 20-year-old cataract patient can look forward to a lifetime of normal vision, thanks to her intraocular lens implants.

The Path of Compassion

Many of the first Zen teachers in America taught not only Buddhism, but disengagement from activist politics. (Many Japanese monasteries historically enjoyed the sponsorship of emperors.) But in the last ten years, American students have become less imitative and are finding their own voices. This anthology includes contributions from the Dalai Lama, Jack Kornfield, Thich Nhat Hanh, Joanna Macy, Robert Aitkin, a woman who was raped after a sesshin, and a British monk who ran for Parliament. Contributors argue that there is nothing inherently Buddhist about social passivity. It introduced me to traditional Buddhists, especially in the Theravada traditions of Sri Lanka and Burma, who integrate religion and politics much as Gandhi did. —Katy Butler

• Although Mahayana Buddhism has a grand vision of universal salvation, the actual achievement of Buddhism has been the development of practical systems of meditation toward the end of liberating a few dedicated individuals from psychological hangups and cultural conditionings. Institutional Buddhism has been conspicuously ready to accept or ignore the inequalities and tyrannies of whatever political system it found itself under. This can be death to Buddhism, because it is death to any mean-

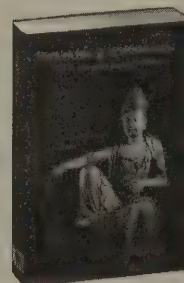
ingful function of compassion. Wisdom without compassion feels no pain.

No one today can afford to be innocent, or to indulge themselves in ignorance of the nature of contemporary governments, politics, and social orders. The national polities of the modern world are "states" which maintain their existence by deliberately fostered craving and fear: monstrous protection rackets. The "free world" has become economically dependent on a fantastic system of stimulation of greed which cannot be fulfilled, sexual desire which cannot be satiated, and hatred which has no outlet except against oneself, the persons one is supposed to love, or the revolutionary aspirations of pitiful, poverty-stricken marginal societies. The conditions of the Cold War have turned most modern societies — both Soviet and capitalist — into vicious distorters of true human potential. They try to create populations of *preta* — hungry ghosts, with giant appetites and throats no bigger than needles. The soil, the forests, and all animal life are being consumed by these cancerous collectivities; the air and water of the planet is being fouled by them.

There is nothing in human nature or the requirements of human social organization which intrinsically requires that a society be contradictory, repressive, and productive of violent and frustrated personalities. Findings in anthropology and psychology make this more and more evident. One can

prove it for oneself by taking a good look at Original Nature through meditation. Once a person has this much faith and insight, one will be led to a deep concern with the need for radical social change through a variety of nonviolent means.

The joyous and voluntary poverty of Buddhism becomes a positive force. The traditional harmlessness and avoidance of taking life in any form has nation-shaking implications. The practice of meditation, for which one needs only "the ground beneath one's feet," wipes out mountains of junk being pumped into the mind by the mass media and supermarket universities.



The Path of Compassion
(Writings on Socially Engaged Buddhism)
Fred Eppsteiner, Editor. 1988; 220 pp.
\$14 (\$17 postpaid) from Parallax Press,
P. O. Box 7355, Berkeley, CA 94707;
510/525-0101 (or Whole Earth Access)

Something Good for a Change

*In **Something Good for a Change**, Wavy Gravy gives us a genuine taste of the mind and heart of hippiedom. A trained actor, he makes all of life a tragicomic improvisational theater in a way that is truly fun, and spiritually liberating as well. The book is full of sweet gossip, the kind that Buddha wouldn't mind having around the well.*

Working with Wavy for thirteen years in the Seva Foundation, I have come to deeply appreciate and honor the way he melds spiritual perspective with real caring for people. He's here and there at the same time. Not bad for a guy who is continually in pain from a bad back.

Kids love Gravy. And so do I.
—Ram Dass

• Here are some tips for producing your own benefit:

Try to get a direct line to the artist. Managers and agents are often engaged by the artists as a buffer between them and the countless requests they get to do benefits. Don't be discouraged if they don't return your calls. I remember being particularly bummed when some manager didn't call me back. Bill Graham popped it in perspective: "You got to remember, Wavy, ten percent of nothin' is nothin'." So don't get paranoid, just keep chippin' away at it. All they can do is say no. And it only takes a couple of yeses to build your show.

Make sure that all your yeses can attract an audience. It may come as a shock to hear that *most benefits lose money*. This can be avoided by checking to see if your acts are a draw before you accept their generous offer to perform. Many groups are desperate for any kind of exposure and sometimes this is a wonderful opportunity for everyone concerned. If your organization can sell a lot of tickets to its own membership, you can focus on the aesthetic rather than the commercial aspects of the show.

If your show does well, you have the potential to make it an annual event. These become easier to sell tickets to with each successful year. If your show is well produced, word gets around.

Always procure a good sound system and a skilled technician to run it. You can skimp a little on other production values, like venue and lighting, but if the show sounds bad everybody loses — the audience, the artist, and you. If you are a bona fide non-profit charity, many sound companies will give you a discount.

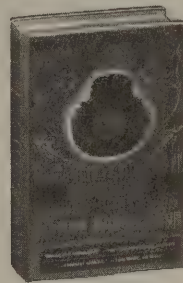
Never put money down on a date before you line up your talent. Most auditoriums will hold several dates for a limited time. You'll be surprised how the choice of more than one date makes the mix-and-match of putting a show together that much easier. Once you have all the talent in tow, allow at least six to eight weeks to promote your show. . . .

If your event is a genuine benefit you are entitled to free listings in the newspapers, and on radio and television stations. It is a must to send your press releases to the public service director or datebook listings person within their necessary lead time. Then — and this is very important — you must call back and make sure your release has been received, and (if possible) that it is being implemented. The media is constantly assailed with entertainment notices, many of which slip through the cracks. It is often a given to have a certain amount of pay advertising in the popular press. Try to find the best timetable for your ads, and see if there is any possibility of a feature article prior to the event.

It is a good idea to check with the artists and their management for their availability to do a phone or in-person interview before the performance. We really lucked out in Canada because our artists were so committed to the success of the concert, we were able to pull off the press conference. This was slapped together exquisitely by Dick Flohill and was held at Toronto's Bamboo Club during an afternoon when the club was inactive. Bob and Jerry flew in from Buffalo where they happened to be performing that weekend. Such windows of opportunity are rare and must be pounced upon with great vigor. Danny Rifkin was key in all Dead-related doings, and was invaluable to me in dealing with ticket sales and the heavies at Kingswood.

It is a very warm feeling to sell out your show in advance and not have to rely on the crap-shoot of a walk-up attendance. We worked very hard for our sellout. The folks at Seva Canada had me doing an interview every four hours during the final two weeks before the show. The best advertising in the world is word of mouth. Its benefits, however, don't generally kick in until you have achieved a certain quantum mass, and that only comes about after a lot of work, from the organization of an opening press conference to each flyer handed out on the street. The rule of thumb is ten flyers equal one attendee.

Don't feel you have to start out with a mega-event like the Third Eyeball. Start small and do it in your own community.



Something Good for a Change

(Random Notes on Peace Thru Living)

Wavy Gravy, 1992; 243 pp.

\$18.95 (\$21.95 postpaid) from Seva Foundation, 8 N. San Pedro Road, San Rafael, CA 94903; 800/223-SEVA (or Whole Earth Access)

Beware of fast talkers who want to get you Bob Dylan and the Rolling Stones on world satellite TV. Don't feel it's the end of the world if you don't make money every time.

My first big Seva event was at Carnegie Hall in New York City. "Sing Out for Sight" featured lots of old folkies: Odetta, Tom Paxton, Bob Gibson, Peter Yarrow, Happy Traum, Peter Rowan, the Josh White Singers. We had an extremely successful press conference at the United Nations, a fabulous performance, and lost about three thousand dollars at the box office.

Why did I lose money on such a great show? Well, since you asked, Carnegie Hall is not cheap and I booked the show on the eve of Yom Kippur, when many of my potential audience were off knocking at their parents'. I have since done several successful incarnations of the "Sing Out for Sight" format. To assure success, in addition to the usual assemblage of folk acts I get a couple of red-hot rockers to unplug and play acoustic. We've had Jerry and Bobby, Jorma Kaukonen, Rick Danko, Crosby, Stills, and Nash, Paul Simon, Dr. John, Bonnie Raitt, and Stevie Ray Vaughn, to name a few. We sold out nearly every show.

So that's it. To review, here are the two secrets of success:

1. Never count your money till it's spent.
2. Never, ever book a show on Yom Kippur.

Now you're in the benefit business.

The Amnesty International Handbook

Published on Amnesty International's 30th anniversary, this is a succinct do-it-yourself manual that takes us step by step through the process of writing polite letters on behalf of prisoners of conscience worldwide. The **Handbook** notes that this simple act has made the difference between prison and freedom in over 38,000 cases since 1961.

I especially appreciated the caustic use of cartoons to preface each segment of hope and horror. It takes real courage to employ humor as a light against the darkness of torture and degrading treatment of fellow human beings. It's so heavy it's light. —Wavy Gravy

■ Torture, as defined by the 1949 Geneva Convention, is "the deliberate, systematic or wanton infliction of physical and mental suffering by one or more persons acting alone or on the orders of an authority, to force another person to yield information, to make a confession, or for any other reason which is an outrage to personal dignity."

To most people, torture is a repugnant and unspeakable practice. Yet during the 1980s, torture and ill-treatment of prisoners was reported from over 90 countries — more than half the countries of the world. These torturing nations cover all five continents and include liberal democracies as well as totalitarian regimes.

● In some countries children have been taken from "subversive" parents and illegally adopted. There may be as many as 400 children missing in Argentina today as the result of a deliberate policy of forced adoption practiced during the late 1970s. Children of parents who "disappeared" at the hands of the security forces were either taken by families connected with those forces or sent to orphanages. Sra. Estela Carlotta was a founding member of the Grandmothers of Plaza de Mayo, a human rights group formed to trace the whereabouts of these "disappeared" children. Her own daughter, Laura, was a victim of Argentina's "dirty war." Pregnant when abducted on November 26, 1977, Laura is known to have given birth to a boy on June 25 or 26, 1978. Sra. Carlotta had the dead body of her daughter returned to her two months later, but never received any news of what had happened to her grandson. As she says:

"Someone has him. Someone is bringing him up. Someone took him from my daughter five hours after he was born."

Many children have "disappeared" together with their families, or even with an entire

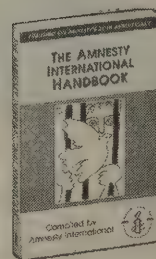
community. In August 1983, 8,000 members of the Kurdish Barzani community were seized in Iraq. Among them were 315 children between 8 and 17 years of age at the time of their arrest. Their fate and whereabouts remain unknown.

● If there is no local Amnesty group in your area, you may wish to start one. The regional office will send you a packet of information on Amnesty's policies, structure, and group responsibilities. Tips on how to organize meetings, raise funds for your group and work with other AI groups, in addition to campaign strategy and letter writing, are also included.

● **Individual Members**
There are many ways for people to become involved with Amnesty's work. Members actively contribute to the movement by paying dues (\$25 a year for regular membership; \$15 a year for students, senior citizens, and low income citizens) and writing letters. They can join Freedom Writers, the Urgent Action Network, or respond to appeals reported in *Amnesty Action*, a bimonthly newspaper which keeps them informed with news about Amnesty International and human rights worldwide. *Amnesty Action* allows members to participate in campaigns, anti-death penalty work, and individual prisoner cases.

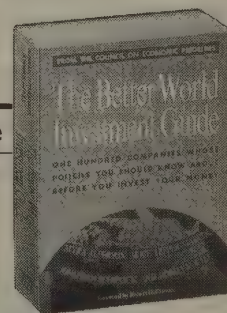


"I can't remember whether I was writing a subversive novel or reading a subversive novel."
David Haldane



The Amnesty International Handbook

Amnesty International, 1991; 145 pp.
\$9.95 (\$11.95 postpaid) from Hunter House, 2200 Central Avenue #202, Alameda, CA 94501; 510/865-5282



The Better World Investment Guide

In *Shopping for a Better World* (Ecolog p. 109) The Council On Economic Priorities advises consumers who desire to buy the products of companies that adhere to certain ethical principles. They're at it again with this investment guide. Companies are rated for policies on charity, advancement of women and minorities, military and nuclear contracts, animal testing, community outreach, environment, PACS, family benefits, and disclosure of information. The rating methods and other matters are discussed in detail. It's not perfect, but you can get a good idea of whose hat is what color. —J. Baldwin

● Apple is apparently the first Fortune 500 company to provide employees a choice of giving at the company to nonprofit organizations outside of the United Way umbrella, according to *Nonprofit Times*. These include many local environmental and healthcare groups.

The Better World Investment Guide

Myra Alpers, Alice Tepper Marlin, Jonathan Schorsch, and Rosalyn Will, 1991; 528 pp.
\$19.95 (\$22.95 postpaid) from The Council on Economic Priorities, 30 Irving Place, New York, NY 10003; 800/822-6435

■ In 1989, Black Enterprise magazine included Philip Morris among "The 50 Best Places for Blacks to Work." Its assessment of the company, which highlights Philip Morris' achievements in hiring and minority purchasing, makes no judgment of product or of the impact of the tobacco industry on the black community. Studies by both the

Investing From the Heart

When the concept of socially responsible investing — in which investors put their money where it is at worst acting harmlessly and at best doing some social good — first became a noticeable phenomenon a few years ago, the Wall Street good-old-boy network put out the wisdom that SRI offered less return on the dollar than standard, go-for-the-jugular investments.

Authors Brill and Reder argue that SRI has grown to the point (\$625 billion last year) where it offers returns no worse than standard investing, and in many cases much better. The explanation is both simple and encouraging to do-gooders: socially responsible companies tend to be better-run, to employ happier, better-motivated and more productive workers, to have closer ties to their communities, and to come closer than other companies to embodying the ideal of virtuous capitalist enterprise. These companies also are far less likely to be vulnerable to employee (harassment, occupational health and safety) or government (pollution) suits, so their profits are not as likely to be drained by wasteful litigation.

This book shows ordinary folk that they too can and should play the SRI game, for their own good as well as society's — and it provides a course in the game itself. The authors outline entry-level options, from socially responsible credit cards to few-dollars-a-month mutual funds; describe social issues investors

may want to use as screening criteria; offer a "money management primer" to help the beginner construct an overall strategy; and describe the various kinds of investments. Worksheets for determining net worth, defining goals, tracking investments, etc., are also included. Appendices list companies by social category, refer to "socially responsible stock indexes," describe "high-social-impact investing," refer the reader to other resources, and compile an SRI glossary.

Investing From the Heart leaves us in the embarrassing position of no longer being able to say we don't know how to put our money to good use.
—Phil Catalfo

Conventional investors mainly read numbers. Numbers are essentially cut and dried; the issues that socially conscious investors consider with the numbers are not. Your broker should be able to provide you with all the information you request to help you with the financial aspects of your investment decisions. However, not all ethical decisions are that obvious, even after you have gathered all the available details. . . .

A fictitious example: Amalgamated Automobile has an excellent record of hiring minorities (yay!). On the other hand, it has no female executives (boo!). It makes one of the highest-quality automobiles on the road, its cars giving consumers great value for their money and superb fuel economy (yay!). None of its models are equipped with airbags (boo!).

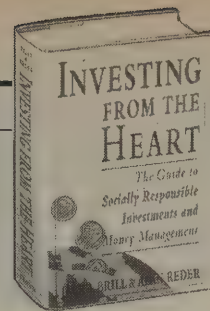
Department of Health and Human Services and the American Lung Association with the National Cancer Institute have determined that black men and women smoke at a higher rate than do white men and women, and that in the last 30 years the lung cancer rate has increased four times faster among blacks than among whites. (Some blacks who welcome Philip Morris's financial support note that blacks are able to make their own decisions regarding tobacco use, and criticize Philip Morris's critics for taking issue with the company's actions within minority communities.)

Philip Morris has found itself in hot water for more than tobacco marketing. In 1989, an expensive ad campaign for Miller Beer targeted at college-age students backfired when it used blatantly sexist and insulting humor to plug the product. Students at a number of universities, including Wisconsin and Iowa, staged protests against Miller, and the Wisconsin University student newspaper called for a boycott. In 1990, groups supporting equal rights for homosexuals launched a boycott against Miller to protest its political contributions to Senator Jesse Helms, an opponent of gay rights.

- ✓ Top rating
- ✓ Middle rating
- ✗ Lowest rating

Giving to charity	Advancement of women	Minority advancement	Military contracts	Animal testing	Disclosure of information	Community outreach	Nuclear power	South Africa	Environment	PACS	Family benefits
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Product or Company	Apple Computer, Inc.	✓	✓	✗	No	?	✓	✓	No	No	✓	No	✓
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Investing From the Heart (The Guide to Socially Responsible Investments and Money Management)

Jack A. Brill and Alan Reder, 1992; 414 pp.

\$20 (\$23 postpaid) from Random House/
Order Dept., 400 Hahn Road, Westminster,
MD 21157; 800/733-3000
(or Whole Earth Access)

Of course, not all socially conscious investment decisions are this complex. You may find some that are completely straightforward as far as your values are concerned. The key issue here is *priorities*. Do not compromise on those issues of greatest importance to you, but remember that a little bending is required in almost all aspects of life.

PETA estimates that fourteen million animals die each year to test personal care and household products. The most common tests include the Draize eye irritancy test, in which caustic substances are dropped into the eyes of unanesthetized rabbits; lethal dose tests such as the LD50 test, in which animals are force-fed toxic substances until 50 percent of the subjects die; and inhalation and dermal toxicity tests, in which animals are forced to inhale toxic substances or absorb them through their skin.

It should be noted that major companies such as Avon, Benetton, and Revlon ceased animal testing altogether after being pressured by consumers and shareholders in 1988. The Estee Lauder Companies and Clarins of Paris were among those banning animal tests forever in 1990. The Council on Economic Priorities cites S. C. Johnson and Colgate-Palmolive as companies still animal testing that have taken great strides in reducing such tests and/or actively seeking alternatives to live testing. . . .

At the opposite end of the spectrum are companies that have resisted all pressure to reconsider their dependence on animal testing. The most notorious of these seems to be Gillette, frequent target of PETA-organized demonstrations in 1990. PETA literature is quick to point out that PETA's companion demonstrators included environmentalists protesting the company's pollution record and antiapartheid activists angered by the company's continuing holdings in South Africa.

BY GEETA
DARDICK

CONFESSIONS of an Access Junkie

IN 1963 I FELL IN LOVE WITH SAM DARDICK, A MAN WHO HAPPENED TO HAVE A DISABILITY. After I announced my engagement to Sam, some narrow-minded “friends” tried to convince me that I shouldn’t choose a wheelchair user for a husband, but I ignored their negative comments. To me, Sam Dardick was a charming and sexy guy, and the fact that he’d had polio as a kid didn’t dampen my ardor for him.

Still, during the early years of our marriage, when we lived in St. Louis, Missouri, Sam’s wheelchair proved a problem for both of us. We’d try to rent an apartment, and find that 100 percent of them had stairs; we’d go to the movies: stairs again. We’d plan to take the bus . . . more stairs. It soon became obvious that architects, builders, and designers did not take Sam’s and my needs into consideration (ironic, as Sam was a graduate of Washington University School of Architecture).

I felt extremely annoyed every time we encountered an architectural barrier, but I had no way to vent my anger. There weren’t any disability laws in Missouri at that time. All I could do was stuff my feelings about the lack of wheelchair access and move on with my life.

By 1969 we had three children, and a townhouse with an elevator in it. We were quite active in the Black Civil Rights movement, and gave wild, integrated parties, where I’d stand under the elevator and let it come down on my head, much to the shock of the guests who didn’t realize the elevator had a sensor in it. We never considered joining a Disability Rights movement, because nothing like that existed.

In 1970, we gave up our urban lifestyle. We drove from Spain to India in a VW bus, and stayed there for two years. When we returned to the US, we bought land on the San Juan Ridge in Nevada County, California, and became back-to-the-land farmers. Now I worried about the simple things in life, like keeping the woodstove burning so the cabin would be warm enough for the whole-wheat bread to rise. Access seemed irrelevant, as we rarely left our land.

MY FEELINGS ABOUT ACCESSIBILITY issues remained dormant for many years; then one sunny day, in the spring of 1984, like Rip Van Winkle, I woke up. Sam and I were celebrating his birthday by lunching together at the Posh Nosh Restaurant in Nevada City. After we paid for our beers and pastrami-on-rye sandwiches, Sam suddenly felt an urgent call of nature.

He wheeled his wheelchair over to the bathroom and discovered that the door was two feet wide. His wheelchair measured two and one-half feet wide. There was no way his chair was going to pass through that door.

Sam wheeled back to our table, located about 20 feet from the bathroom door. Without telling me what he intended to do, Sam jumped out of his wheelchair, and dropped himself onto the floor of the restaurant. And then he started crawling rapidly toward the bathroom door.

Paraplegics like Sam can use their arms, but not their legs. Sam’s crawl was a two-handed movement in which he dragged himself across the room, like a caterpillar. I sat there watching him in disbelief. Here was the man who was my lover, my hus-

Photographs by Geeta Dardick



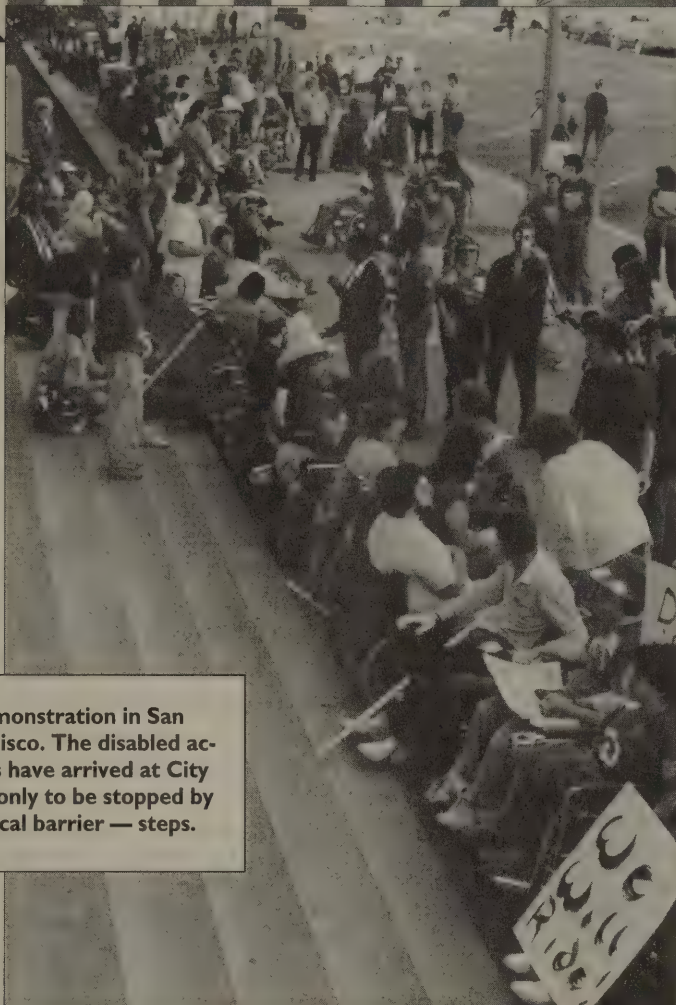
The author with her husband, Sam Dardick.

Citizens elect representatives who make laws that reflect the will and needs of the citizens. That’s how democracy is supposed to work. But knowing how to use the law and how to make sure it is enforced has a lot more to do with the way people really live. That was one clear lesson from the Civil Rights movement.

Geeta Dardick, a longtime WER reader and contributor from the Sierra Nevada foothills, sent us this piece. Right-of-access is a civil right; Dardick shows us why and tells how to help fight for it.

—Howard Rheingold

A brief analysis of the Americans With Disabilities Act



A demonstration in San Francisco. The disabled activists have arrived at City Hall, only to be stopped by a typical barrier — steps.

band, the father of my three children, the president of the San Juan Ridge School Board, a guy with graduate degrees in architecture and city planning, a guy who had been Deputy Director of the St. Louis Model Cities program, a guy who was the fastest goat milker on the planet: here he was, being forced to crawl across the floor of the Posh Nosh Restaurant to use the bathroom. As I watched Sam crawling, I pledged that I was going to do something, to help make sure that neither my husband nor anyone else would be forced to crawl to a bathroom again.

The following day I started making

phone calls. I found out that California already had laws requiring wheelchair accessibility. I also found out that Sam and I could join a state-sponsored program, called the Community Access Network (CAN), which would teach us the state's access codes, and then send us back into Nevada County to enforce the codes.

That summer, I trained as a CAN volunteer; from that moment on, I became an access cop, with my evil eye turned on the county's innumerable inaccessible structures (my all-time favorite was the new supermarket constructed without any wheelchair-accessible checkout stands). Rather

than act alone, Sam and I networked with persons from all disability groups (deaf, blind, wheelchair, crutches) and formed a broad-based local access committee to raise community awareness of the need for accessibility and to police new construction projects.

During the next few years, Sam and I volunteered thousands of hours for disability causes throughout California. We marched for access to public transportation in San Francisco, testified for accessible apartments in Sacramento, busted inaccessible city-council meetings in Nevada City, and started an Independent Living Center called FREED in Grass Valley. Every victory was celebrated with gusto, but there was always one caveat. We realized that the state of California, with its progressive legislation promoting architectural accessibility, was more advanced on disability issues than most other states. Would the fight for accessibility have to be fought over and over again in every state in the nation? Wasn't there ever going to be a national disability policy?

WE DIDN'T HAVE LONG to wait. Back in 1984, at about the same time that Sam was crawling to the bathroom at the Posh Nosh, President Ronald Reagan directed the National Council on the Handicapped (a small group of Reagan appointees) to prepare a special report. This paper would present legislative recommendations for enhancing the productivity and quality of life of Americans with disabilities.

The council's report, submitted to President Reagan in 1986, was entitled *Toward Independence*, and it was much more hard-hitting than might have been expected. It recommended "enactment of a comprehensive law requiring equal opportunity for individuals with disabilities, with broad coverage and setting clear, consistent, and enforceable standards prohibiting discrimination on the basis of handicap." That bold recommendation was the seed that resulted in the development of legislation for an Americans with Disabilities Act

(ADA), the first national civil-rights bill for people with disabilities.

Passage of disability legislation required the support of congressmen and senators throughout the country. In 1988, when the first version of the ADA was introduced into Congress, supporters of the bill felt that most elected officials were not truly aware of the need for comprehensive civil-rights coverage for disabled people.

To raise awareness of the existing discrimination, congressman Major Owens appointed a task force to travel around the country and take testimony from people with disabilities. Owens asked Justin Dart, a wheelchair user with extensive experience in business and government, to chair the task force.

Throughout 1988 and 1989, Justin Dart conducted 63 public forums in 50 states, the District of Columbia, Guam, and Puerto Rico, taking testimony from more than 7,000 individuals with disabilities, their families, advocates, and service providers. When the task force came to Northern California, Sam and I drove the

seven-hour round trip from Nevada County to Oakland to give our testimony. Sam spoke about facing job discrimination while a graduate student at UC Berkeley in 1959. (He had won a contest guaranteeing him a summer position with the city of Berkeley, but lost the job to another student. The reason: the city officials refused to hire a student who couldn't walk.)

I spoke about the discrimination I had experienced as the non-disabled partner of a wheelchair user. "When a restaurant, theater, store, or library has no access ramps," I said, "it affects the entire family, not just the person with the disability."

The task force collected 5,000 specific examples of discrimination, which helped to prove the need for the passage of the ADA. Then we all started lobbying every member of the Senate and House of Representatives, to make sure they voted for the ADA.

Opposition to the ADA, from business and transportation interests, forced disability leaders to wheel and deal. The right to universal health-insurance coverage was bartered away in order to receive support for the bill from some key legislators. After a great deal of behind-the-scenes negotiation, the ADA passed the House of Representatives 377-28

and the Senate 91-6, with most important segments still intact.

Sam and I flew to Washington, DC, to watch President Bush sign the bill on July 26, 1990. Seated on the lawn of the White House amidst 2,000 persons with disabilities (many of whom were weeping with joy), I felt privileged to witness such an historic event.

When President Bush gave his speech, which was simultaneously interpreted into sign language, he compared the discrimination against disabled people to the Berlin Wall. "Today I am going to take a sledgehammer to another wall," he crowed. "Let the shameful wall of exclusion finally come tumbling down."

THE ADA IS A VERY comprehensive piece of legislation. The regulations of the ADA (which went into effect on January 26, 1991) will eliminate many of the barriers faced by people with disabilities.

All "public accommodations," such as restaurants, hotels, medical offices, and retail stores, will need to be built with full accessibility. (Adding accessibility to a new structure increases the total cost by one percent or less.) Typical accessibility features include ramps, bathrooms with ample space for wheelchairs to turn around, and



Judy Heumann, who runs the World Institute on Disability, cheers at a San Francisco rally for the right to have access to public transportation.

FOR MORE INFORMATION

To receive more specific information about the contents of the ADA and how you can help implement this important law, contact the following organizations:

Office on the Americans with Disabilities Act
Civil Rights Division,
United States Department of Justice
P. O. Box 66118, Washington, DC 20035-6118.
202/514-0301 (voice);
202/514-0381 (TDD).

Community Action Network
California State Department of Rehabilitation:
916/445-8638.

President's Committee for Employment of People With Disabilities
111 20th Street NW,
Washington, DC 20210.
202/653-5044 (voice);
202/653-5050 (TDD).

Equal Employment Opportunity Commission
1801 L Street NW,
Washington, DC 20507.
800/669-EEOC (voice);
800/800-3302 (TDD).

Department of Transportation
400 7th Street SW,
Washington, DC 20590.
202/366-9305 (voice);
202/755-7687 (TDD).

The Disability Rights Education and Defense Fund (DREDF)
2212 6th Street,
Berkeley, CA 94710.
800/466-4ADA (voice and TDD).

lightweight doors that are easy to open.

Businesses that decide to remodel will have to make the remodeled area accessible, as well as the path of travel to the remodeled area. In existing buildings, inaccessible features must be eliminated if such changes are "readily achievable" without much difficulty or expense. An example would be placing a ramp over one or two steps leading into a store or office.

Businesses must provide auxiliary aids to enable a person with a disability to use available materials and services. For example, any video presentations about products would need to be closed-captioned for the deaf, and brochures would need large print so that those with low vision could read them. Another example: providing special pens with large, spongy handles that are easy to hold: helpful for many people with arthritis.

The ADA also makes major changes in employment criteria. Under the ADA, an employer cannot refuse to hire a qualified applicant with a disability, just because of the person's disability. However, an employer does not have to give preference to a qualified applicant with a disability over other applicants.

Also, an employer must make "reasonable accommodations" for a person with a disability so they can perform their job. This might mean putting an amplifier on a telephone, lowering a desk, or establishing a flexible work schedule. And in new or remodeled facilities, all employee areas including sales areas and service areas must be made fully accessible. However, if the accommodations would impose an "undue hardship" (be too costly), they will not be required.

There are many incentives written into the law to encourage businesses to comply with the ADA. Businesses can receive tax deductions of up to \$15,000 for the removal of architectural barriers (for example, if it costs \$12,000 to replace stairs with a ramp, the entire amount is tax-deductible).



When Sam Dardick isn't working on disability issues, he likes to unwind by playing wheelchair basketball.

Businesses can receive tax credits equal to 50 percent of all costs of meeting the Americans with Disabilities Act, providing those costs are over \$250 and under \$10,250. If (for instance) you hired a sign-language interpreter as a consultant to be present for the signing of contracts with deaf buyers, or if you made a workstation accessible for an employee who used a wheelchair, half of the cost could be deducted.

Public services also come under the umbrella of the ADA. All new public buildings and all new buses and rail vehicles must be accessible. By 1993, telephone companies must provide telecommunications relay services for hearing-impaired and speech-impaired individuals, 24 hours a day.

OF COURSE, PASSING A law is only a first step to full equality. Implementation is the second step, and just as important. Congressman Steny Hoyer put it most succinctly when he said, "Passing ADA was incredibly historic. Now every day we

must fight to make sure that the words in the law, the words on the White House lawn, the words in the House and the words in the Senate become reality for 43 million Americans with disabilities and millions more around the world who are looking to American leadership for the rights of the disabled."

Over the next ten years, the ADA will improve the lives of Americans with disabilities and their family members. Many businesses are already working to comply with the law, but others will try to ignore it. There will be thousands of civil suits as people with disabilities take public and private entities who break the law to court. As for the Posh Nosh Restaurant: they still don't have to have an accessible bathroom, as their building was built before any laws (California or federal) went into effect. That's why Sam and I never went there again. We try not to patronize places that don't provide accessibility. Like who wants a pastrami-on-rye sandwich, anyway? 🍷

Mood, Food, and Sunlight BY HANK ROBERTS

Not all moods teach us something, and not all impulses lead us toward being happy. As a general rule, we do what we feel like, until we're satisfied. Sometimes, the naturally-arrived-at result doesn't feel very good.

Sometimes eating and sleeping when we want to leaves us fat and crabby; ups and downs in weight and mood seem to go together. Trying to ignore hunger to reduce weight may lead to yo-yo dieting. Combining self-improvement approaches that enhance one another can make success more likely.

Satisfaction is, in part, a matter of brain chemistry. Chemical pathways in the brain, some of which we experience as moods, change when we start to exercise, to plan meals, or to increase our exposure to bright light. The satisfied feeling from these approaches adds up.

The body clock can be reset by bright light, enabling sound sleep. Seasonal depression is helped by bright lights; it also responds to artificial light that changes like dawn and sunset on a summer day, perceived partly before awakening. After 20 years of research in Europe, medicines that affect serotonin levels are becoming available in the US; these can directly change the body chemistry associated with mild moodiness, seasonal affective disorder (SAD), PMS, anorexia, and bulimia.

The eating disorders that can be set off by dieting resemble the wobble that follows any shove in a dynamic system. We may soon see whether the conscious mind will do any better at controlling mood than body weight. Some of these tools may help.

Tools

Society for Light Treatment: P. O. Box 478, Wilsonville, OR 97070; 503/694-2404.

Dawn Simulator: Medic-Light, Inc., Yacht Club Drive, Lake Hopatcong, NJ 07849; 201/663-1214.

National Organization for Seasonal Affective Disorder (NOSAD): P. O. Box 451, Vienna, VA 22180. Info packet \$5; membership \$25/year.

Further Reading

"What Good is Feeling Bad — The evolutionary benefits of psychic pain," Randolph M. Nesse, *The Sciences*, Nov./Dec. 1991 and *Letters*, Mar./Apr. 1992.

"Fat is a psychological issue," P. Herman and J. Polivy, *New Scientist*, 16 Nov. 1991, p. 41.

"A Change of Heart," George Leonard, *In Health*, Dec./Jan. 1992.

"Carbohydrates and Depression," R. and J. Wurtman, *Scientific American*, Jan. 1989, p. 68; "Brain, Food," *Scientific American*, Nov. 1991, p. 124.

"Long Term Weight Loss," Michael Weintraub, *Clinical Pharmacology and Therapeutics*, May 1992, p. 51.

"The Material Basis of Emotions," Candace Pert, *Whole Earth Review* #59 (Summer 1988), p. 106.

"Clinical Experience with Serotonin Reuptake Inhibiting Antidepressants," J. Mendels, *Journal of Clinical Psychiatry*, 48:3 (Supp.), Mar. 1987.

The Carbohydrate Addict's Diet

(The Lifelong Solution to Yo-Yo Dieting)

Richard F. Heller and Rachael F. Heller, 1991; 283 pp.

\$19.95 (\$21.95 postpaid) from Penguin USA/Cash Sales, 120 Woodbine Street, Bergenfield, NJ 07621; 800/253-6476 (or Whole Earth Access)

When carbohydrates are eaten less frequently, less insulin is produced. The body has a lowered tendency to store the excess calories in its fat cells and is more capable of breaking down stored fat. In that way, the carbohydrate-insulin-serotonin connection functions more effectively for weight loss. We have found that the less often the carbohydrate addict consumes carbohydrate-containing foods, the more satisfying the foods are — and the greater the control of eating that is possible. In short, we found the over-weight-carbohydrate-addiction cycle can be broken.

Our research has also revealed that when the carbohydrates are consumed during a limited period of time, it appears that the usual overproduction of insulin is decreased.

It is dangerous to allow a minor gain in weight to cause you to radically change your eating; stay with the program and work it.

Give your body a chance to reach a balance. Remember, this is a lifetime program, and therefore, there are inevitable ups and downs.

Seasons may cause weight fluctuations, with gains in the fall and winter and losses in the spring and summer. The best approach is to relax, give it time, stick to the guidelines, weigh yourself daily, record and average the weight, and enjoy yourself. —*The Carbohydrate Addict's Diet*

Seasons of the Mind

Norman E. Rosenthal, 1990; 278 pp.

\$12.50 postpaid from NOSAD, P. O. Box 451, Vienna, VA 22180

Many children with SAD do not understand what is wrong. Often they are not even aware that the change is internal, but blame it instead on the world around them, which they experience as having turned cruel and uncaring. Teachers have become excessively strict and parents unfairly demanding. Many adults similarly misperceive the source of their SAD symptoms and seek external explanations to account for the dramatic difference in the way they feel when they are depressed.

I first started looking for children and adolescents with SAD because about one-third of our adult patients reported symptoms going back to these early years.

The actual number of hours of light needed varies from person to person, at different latitudes, and at different times of the year. For example, in the early fall, as people begin to feel the winter syndrome setting in, it may be enough to use the lights for thirty minutes in the morning. As the days get shorter and darker, more light is generally required. . . . By late February and early March it is usually possible to decrease the length of time gradually until around mid-April, when it may be fine to stop using the lights altogether.

It has been my experience that criticism and derision frequently attend any suggestion that human emotions and behavior are influenced by our physical world. Such physical influences are often not regarded as plausible explanations for our actions, since we consider ourselves to be reasonable creatures. In the early years of our research on the seasons we experienced a great deal of derision over SAD and the postulated effect of light on human mood — until our studies were widely replicated by other research groups.

Ninety percent of Dr. Jamison's group reported that very intense moods and feelings were either integral to, or necessary for, the development and execution of their work.

Investigating the association between seasons, mood, and productivity, Dr. Jamison found a strong seasonal pattern of mood changes among artists and writers, with highest mood scores in the summer and lowest in the winter. Peak periods of productivity, while also seasonal, occurred in the spring and the fall. —*Seasons of the Mind*

You Mean I Don't Have to Feel This Way?

(New Help for Depression, Anxiety, and Addiction)

Colette Dowling, 1991; 314 pp.

\$19.95 postpaid from Macmillan Publishing Company, 100 Front Street, Riverside, NJ 08075; 800/257-5755 (or Whole Earth Access)

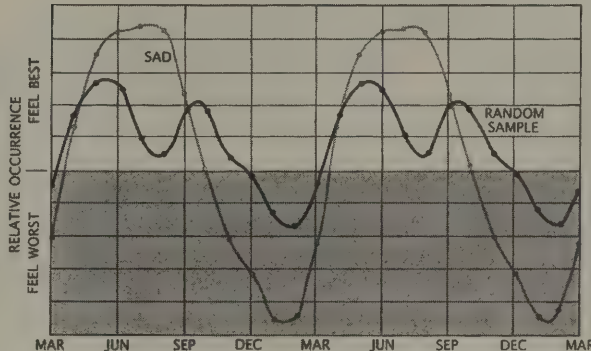
At least one out of ten teenagers engages in dangerous eating practices — starvation diets, bingeing, the abuse of laxatives and diet pills. While such practices don't always lead to full-fledged eating disorders, it can be said that with rare exceptions no one becomes eating disordered who doesn't start out with some extreme method of dieting.

Antidepressants aren't "happy pills." They

don't produce the euphoric "high" of illicit drugs, and they're not addictive. "A person taking an antidepressant who does not suffer from major depression will experience no change in mood whatsoever," Dr. Francis Mondimore writes in *Depression: The Mood Disease*. For the person who is depressed, however, the shift in mood that

results when an antidepressant starts to work can be exhilarating.

Depression is not something that has to be endured. When properly treated, it has an almost 90 percent chance of being relieved. —*You Mean I Don't Have to Feel This Way?*



Seasonal fluctuations in mood are common among people in New York City (and in other northern areas) but are severest in patients diagnosed with SAD. The data are from a study by Michael Terman of the New York State Psychiatric Institute. —*Scientific American*, Jan. 1989 (p. 72).

The Blob That Ate Oaxaca

In this book of travel essays, Carlos Amantea (aka Lorenzo Milam) writes of driving his wheelchair down a Madras street crowded with buses, pedicabs, pedestrians, cows, and cowflop. He meets *The Whining American in Costa Rica*, worries about Mexican mosquitos, and counts the dragons outside his car on a deserted road. Amantea writes with great wit, but there is another aspect to his writing, a brooding over aging, death, desire and the spiritual impoverishment of America.

The kaleidoscopic journey makes you want to leave your routine and vamoose. Unfortunately, this was Amantea's last work, according to the author's note, which also says this is a novel. One concludes this book, whatever it is, wondering whether Amantea/Milam is dead or alive, whether his travels were as fabulous as Gulliver's, and whether one's leg has been pulled. —Mark O'Brien

Like colonial powers of all times and all persuasions, we savor exporting our desires, our dreams, our addictions, and our lusts. Too steamy for our own shores — we relegate our Sins to countries like Peru, the Dominican Republic, Colombia, Belize, Mexico, the Philippines — much as England a century ago would relegate its dopeheads and philanderers and pederasts to Nairobi, India, Egypt. That left England, as it does us, free to pretend the purity of the

Christian Home State. Castro knew this. He didn't want to free Cuba from Fulgenio Batista as much as he wanted to free it from being the whorehouse and opium den for the United States. To this day, his memory is reviled in America because he wasn't content to expropriate our oil refineries and banana plantations; no, he insisted, as well, on closing down the pleasure palaces, the way stations for gringo lusts and passions.

No wonder we're still so miffed at him. Revolution-schmevolution. It's our pent-up libido, and his fake puritanism, that bug us so.

"The problem with a volcano," I tell Al, "is that it is all potential, no kinetic." Like a fifty-year-old whore, it shows all the ravages of time and past profligacies, but very little in the way of contemporary *Sturm und Drang*. Such quiescence is boring. I start to yawn, but at that moment, the ground shakes — at first a little, and then more heavily. The green-and-yellow waters slosh about in the crater. I can see tiny waves lapping the edges as a huge jet of steam streams out of the ground on the far side, half-way down the crater. Out of the corner of my eye I see the tourists scattering, running for their cars. I think it's some joke, something put on by the Volcan Irazu Chamber of Commerce, perhaps, but then great clouds of debris start to fall downwards, into the cone, mixing with uprushing jets of steam. There is a strange flashing at

the bottom of the crater. "Let's get the hell out of here," I yell at Al, but my chair has been jolted, and I find that it's beginning to slip down towards the pit. I try to reverse the motion, but the wheels slip from my hands. As the earth rolls and tumbles, I try to reach Al.

"Hold on," he yells, "grab on to something!" The air is filled with a loud shriek of escaping steam. Boulders roll down towards the center of the inferno. I can feel Al's hands grabbing at the back of the chair, but it is too late. I am lurching forward, slipping down, slipping, irrevocable. Heat and fire surge up; I can smell the thick sulphur, feel it burning my face as I begin downwards . . .



The Blob That Ate Oaxaca

(And Other Travel Tales)

Carlos A. Amantea, 1991; 457 pp.

\$12.95 (\$14.95 postpaid) from Mho & Mho Works, P. O. Box 33135, San Diego, CA 92163 (or Whole Earth Access)



The Chumash . . . were the first California Indians to be seen by whites when Cabrillo landed there. . . . [They] numbered 8,000 to 10,000 in pre-contact times but were extinct by 1910.*

—Guidebook: A Companion to California, James D. Hart (1978).

IT DOESN'T CHIP OFF!

Preserving Native Art and Culture in Southern California

BY A. FIONA HERSHEY

As Chris Columbus takes his knocks this year, one side effect is a kind of anglo rediscovery of native American cultures. What more incongruous place to go for a status report than greater Los Angeles?

Multitalented cover artist and author Allison Hershey is the art director for The Dreamer's Guild, a Los Angeles-based computer software programming collective. She lives in the San Fernando Valley. —Richard Nilsen

"I thought the Indians in this area were wiped out a hundred years ago." The statement came from a man who had entered the Satwiwa Native American Cultural Center ahead of me. Sitting before us in the converted living room/museum were Chumash healers Kote and A-lul' Koy Lotah, the hosts responsible that week for answering visitors' questions.

Kote looked down at himself and shrugged. "Well, I'm still here. My family's still here."

I hadn't intended to get involved with native American cultural concerns when I sought Kote's advice that Sunday afternoon. I am an artist who specializes in depictions of images carved in stone. In my quest to find good reference material, I had found an out-of-print book which featured beautiful color photographs of Indian rock art.

When I looked more closely, I was astounded to find that some of the sites were in my own California backyard — northwestern Los Angeles County. I made some phone calls, which led me to the recently established Native American Cul-

tural Center on National Park Service land near Thousand Oaks.

When it was my turn to talk to Kote, I asked him about the rock art. He pointed to photos on the wall and said: yes, these pictographs were in the hills surrounding Los Angeles, and in Ventura, Riverside, and Orange Counties as well. Some were tantalizingly nearby; on occasion, they were still being created. I asked if I could see them. No, he said; these sites were private, sacred, vulnerable to vandalism. How did he know I would not bring my friends there and damage them? Better I should go to

* There were actually 35,000 to 40,000 Chumash at the time of first contact.

Painted Cave near Santa Barbara, safely tucked behind iron bars, away from spray cans and chisels.

I was abashed, but there was a metaphor in that moment. First I wondered "Why have I never heard of these rock paintings that surround my home town?" Then its echo; "Why were its creators considered extinct?"

LOS ANGELES has the largest, most diverse native American population in the United States. A surprising number of them are descendants of the original people living in the area. They never left; the cities have just grown up around them. Places like Humaliwu (Malibu), Sa'aqtik'oy (Saticoy), and Muwu (Point Mugu) still bear the names of the original villages. So why aren't they recognized?

The Spanish Missions did much to decimate populations, disperse families, and confuse tribal membership. Later, the failure to ratify

treaties signed by California natives denied them federal recognition.

The only proof of their ancestry lay in poorly kept Mission historical documents. The people who remained outside of the Mission system were papered out of existence, even when they continued to carry on their traditions. "Some of those people survived," Chumash Satwiwa member Mati Wuaya said, "Some took off. Some were never documented. If you look at some of those Mission records, they documented what they saw. How many did they leave out?"

The traditional families kept a low profile to minimize the abuse directed at all native peoples. Many even left the culture and called themselves Hispanic. Eventually, American attitudes turned them, and all Indians, into living fossils. Kote Lotah complained, "With native Americans it seems that people want to look at us in a particular time period. They don't allow for the present time. . . . Like, if you don't do it exactly the way it was

done 400 to 1,000 years ago, then it is not authentic."

There has been a struggle between the need to break the silence and the wish to protect their privacy. A-lul'Koy's son Qun'tan revealed why most were continuing to keep a low profile: "It keeps people from invading on us. We like to have a certain space to do our ceremonies. To . . . just leave our stuff alone, our sites alone."

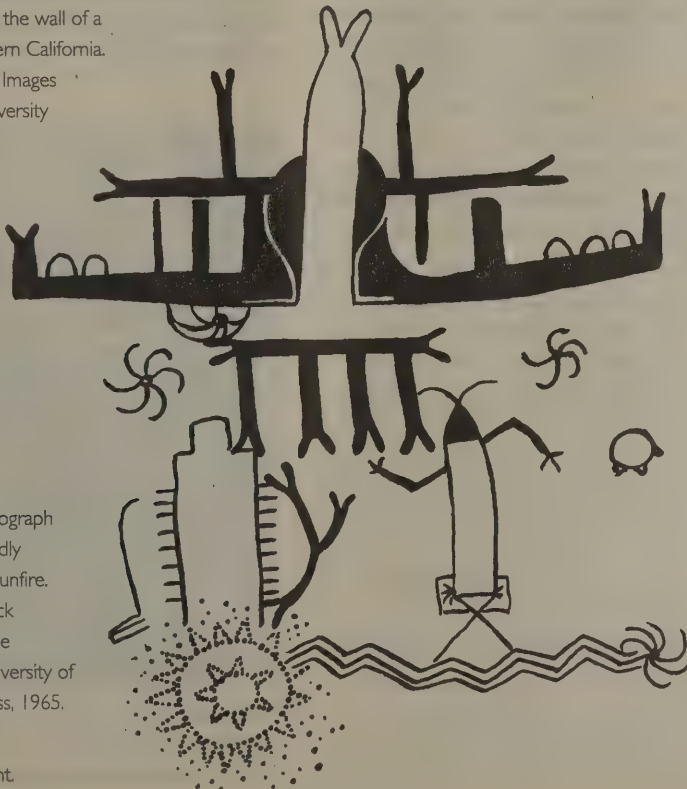
In the last fifty years, freeways were built, tracts of land were bought and sold, archaeologists reaped a rich harvest of artifacts in the Southland, while protests by a handful of individuals were brushed aside. By hastening to call the Chumash and Gabrieliños extinct, government officials, developers, and other interests could proceed with their own plans. If one small group of Indians made a stink by citing laws and cultural heritage, developers could always seek permission from another small group that didn't really care.

To maintain their heritage and prevent further destruction of cultural resources, burial sites, and rock art, leaders in the local communities struggled to confirm their existence. Charlie Cooke, Kote Lotah, and A-lul'Koy Lotah were among the Chumash activists who struggled thirty years ago to free their people from the tomb of history books. The tide turned at the close of the sixties. According to Kote:

"The California Land Settlement Act [of 1969] said all California Indians were to be paid 47 cents an acre for all confiscated lands. A lot of Chumash people took that money. They didn't realize that once they took that money, they were in fact paid off and they had no claims to the land, no say-so anymore. They had been 'justly' compensated. Some of us didn't take that money. That left us in the position of being caretakers of the cultural resources. . . . But what this California Land Settlement Act did was swell the rolls of Chumash from 130 to over 8,000. This gave us a pool of information of people

(Opposite page) A Chumash pictograph on the wall of a cave in Southern California.

From *Ancient Images on Stone*, University of California Press, 1983.



Chumash pictograph from a site badly damaged by gunfire. From *The Rock Paintings of the Chumash*, University of California Press, 1965.

Both books are out of print.

to work with. We went knocking on people's doors and said 'OK, you're Chumash. Let's get involved.' And they were hungry for it."

MOST PEOPLE wonder what tiny portion could be left of these cultural resources. But these sites — the villages, the burials, the rock art — are ubiquitous in Southern California, though for the most part invisible. The rock art is mostly on private property, with a few sites tucked away on public land. There are 90 documented rock-art sites in Los Angeles County alone, some dating back 3,000 years.

During this century, the villages and burials slowly gained a measure of respect from archaeologists and some protection by law. But the rock art, strangely, was ignored by almost everyone. Archaeologists had no interest in it because it was hard to analyze and difficult to date. Its study was relegated to amateurs. National Park booklets mentioned rock-art sites in passing, equating them with the scribbling of children. The sites remained wide open for vandalism and for destruction by developers. Inaccessibility has saved most of what is left today, but the Southland's explosive expansion threatens these sites too.

Because of the new activism coming out of the sixties and seventies, respect for cultural heritage, artifacts, and ancestral remains have become real issues. The seventies and eighties saw new laws that laid down guidelines for dealing with discoveries and with the existing collections in museums and universities. (There have been struggles, of course, regarding enforcement.) The tide also began to turn for rock art. Archaeological fashion shifted from collecting economic artifacts to artistic and cultural ones. Archaeologists became alarmed at the rate the rock art was disappearing, and moved to protect the sites by whatever means they could.

In the nineties, laws have been

The sites remained wide open for vandalism and for destruction by developers. Inaccessibility has saved most of what is left today, but the Southland's explosive expansion threatens these sites too.

passed against damaging or taking artifacts, and regulating construction on sensitive sites. Fences have been put up around some sites on public land. But laws and fences can only do so much; vandalism has been the greatest concern of archaeologists and Indians alike. Secrecy has been the best defense. Says rock-art expert Ed Krupp, "It is extremely important to increase the public consciousness about rock art, while at the same time it is extremely important to keep people from knowing about it. Most people are nice folks . . . but one or two jerks will destroy something forever. That's what the difficulty is. These places get more accessible to people who are terrific. How you get the terrific people the opportunity to see it is a tough problem."

Chumash leader Charlie Cooke put it on a more personal level; "Yourself, you might go there, you might take another person there, you never bother it. Then in their turn, they take somebody else up there . . . and here comes some jerk with a spray can, or they try to chip it out, trying to save a piece of that rock art. And *it doesn't chip off*. Disturbed like that, it's ruined. You can't replace it."

The recent appearance of Indian "wannabes" has caused a new-age headache for the Indians and archaeologists. Ironically, they followed on the heels of newfound respect for native American cul-

ture. Though most of the "wannabes" have tried to be helpful, Kote and A-lul'Koy, Ed Krupp, and others have found reasons to be wary of them.

Ed Krupp told me: "You see a lot of interest today in sort of adopting a very romantic notion about Indians, and wanting to be Indians. I run across stuff at sites. I visited one site . . . there was an extraordinary offering left under one of the panels. The more I looked at the offering, the more confused I got and the less I thought it was Indian.

"A Santa Barbara site had pseudo-pictographs put on it. . . . They were copying pictographs from other sites. I saw this one here, that one there. They were really kind of stupid pictographs, not really well done. I have an admiration for really good artwork. This was pretty trashy stuff."

Kote Lotah was irked by the appearance of Plains Indian offerings at sites meant for California Indians' private use. He placed part of the blame on the Plains Indian teachers who have entered the new-age scene, teaching people without proper grounding in the etiquette of mutual respect. He put it very succinctly:



A-lul'Koy and husband Kote Lotah, Chumash Southern Owl Clan healer-priests, at home in Ventura, California.

A. Fiona Hershhey

"When you say you're an Indian person, that means that you understand what being a native is. The two main principles of being native is *respect* and *protocol*. You *never* go into another man's house and do what you want without permission. You *never* go into another tribe's land without contacting the chiefs or the medicine people or the appropriate authorities and asking permission to do stuff."

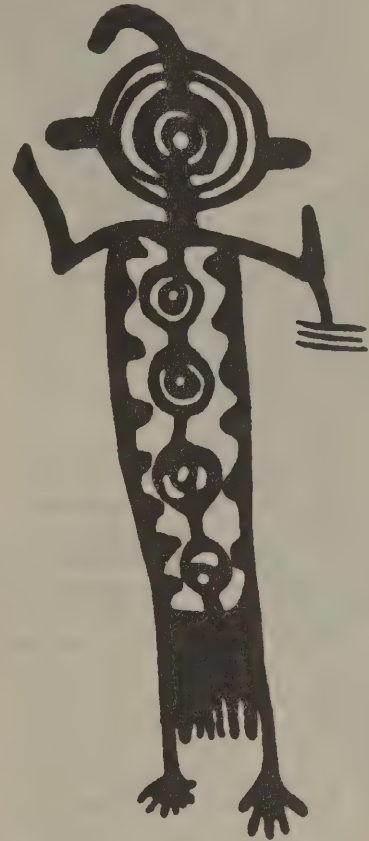
Respect, protocol, and perhaps an author's privilege have earned me a couple of invitations to view some rock-art sites near the San Fernando Valley. Even with these invitations, my visits may alarm the more zealous protectors. This article could also pose a threat by calling attention to the fragile works, causing people to seek them out.

However, it is of great importance to let people know that there are

living legacies among us that should not be engulfed by the uncontrolled growth that flows over the rims of Southern California's valleys. They are not fossils to be removed for display in a museum; they are part of a culture that still exists today.

The threat of obliteration, of building over, of sweeping away is strong throughout California. The issues are complex and have long roots into the past. But the people involved in keeping cultural resources alive have been learning to work together. A new alliance has been growing between native Americans, some archaeologists and the National Park Service. The shared goals are to preserve the sites, restore disturbed artifacts and human remains, and acknowledge an ongoing but changing culture that has never ceased to exist. This

detente is still hot with the frictions of old viewpoints and misunderstandings, but a common direction is emerging. Through the efforts of these people, perhaps the rest of us can learn to take responsibility for all cultural resources, so that our children's children can have them to experience. ☺



Ancient: Images on Stone

American Rock Art Research Association

Association members work to protect and preserve rock-art sites through cooperative action with public and private landowners. Membership is open to all who profess an active interest in non-destructive research and preservation of rock art. —A. Fiona Hershey

ARARA

Membership \$15/year (includes 4 issues of *La Pintura*) from P. O. Box 65, San Miguel, CA 93451

- Los Padres National Forest in Central California has taken the extraordinary step of closing the Pool Rock-Condor Cave area to public entry. . . .

The caves have long been popular places for hikers — to such a degree that heavy visitation to the sites has produced a rapid deterioration of the Chumash rock art, and the establishing of a network of illegal trails, leading to soil erosion. Forest Service archeologist Stephen Horne stated recently: "The main problem is that the caves are being loved to death. We need to reduce negative effects of human visits." Estimates of visitation to Pool Rock to see and often to touch the outstanding Chumash paintings run from 500 to 2,500 yearly. This fragile remnant of the pictographs cannot withstand this immense impact.

The cultural resource staff of Los Padres

National Forest is planning a variety of activities designed to stabilize the rock art and to prevent other resource damage. When this work is completed in 1993, it is anticipated that the Pool Rock-Condor Cave area will be open to groups and individuals with permits and accompanied by a trained docent or guide.

Friends of Satwiwa

Friends of Satwiwa is the support group for Rancho Sierra Vista/Satwiwa, a special natural area devoted to education about local native American resources in the Santa Monica Mountains National Recreation Area. The artifacts and rock art on display are all constructed by living members of the Chumash community, instead of being torn from burials and hillsides. An expanded visitor center and a living demonstration village are under construction. —A. Fiona Hershey

Friends of Satwiwa

Membership \$25/year (includes 4 issues of *Satwiwa News*) from 4126 Potrero Road, Newbury Park, CA 91320; 805/499-2837 or 818/597-9192

- A red-tailed hawk arrived in time for the

Solstice Celebration at Satwiwa and stayed throughout the ceremony. The hawk positioned itself on a middle rung on the northwest side of the unfinished ap (Chumash house), not far from the gathering circle. Hereditary Chief Charlie Cooke explained that it is a positive sign when a bird of prey positions itself so close to the people.

Conducting the Solstice Ceremony were Kote and A-lul'Koy Lotah. They are both Chumash A-Tis-Win (priests and doctors). As he lit the fire in the gathering ring fire circle, Kote Lotah hung a coyote pelt on a three-foot stake protruding out of the ground. The animal had been shot and killed by an unknown hunter and later found by Kote. A-lul'Koy Lotah later explained to a concerned visitor that by using the pelt in the ceremony the coyote's useless death would now serve a purpose.



Managing Tropical Biodiversity

Daniel Janzen has reached the status of media-celebrity scientist for his conservation work in Costa Rica. Of all his exposure, including a NOVA episode, nothing I have encountered has been as informative or exciting as this unassuming cassette of a lecture/slide show he gave at the California Academy of Sciences in September 1991. You don't get to see the slides, and the audience questions at the end are not amplified or repeated, but none of that really matters; Janzen is a compelling lecturer.

Where others peer with frustration into the North-South developmental void, Janzen and his numerous Costa Rican collaborators have made synergies, creating a working model of biodiversity conservation with worldwide application. They are doing this by standing North American conservation dogma and academic hierarchy on their heads. The only way to preserve biodiversity is to use it, says Janzen.

If this sounds suspiciously like an echo of the market-driven "wise use" lobby currently clamoring to have at what's left of wild North America, pay attention: they are different. In the United States, one reaction to bungling land-use bureaucracies is still more free enterprise, as corporate wolves slip into "wise use" citizen-activist clothing. What's happening in Costa Rica is built upon a strong governmental presence, but one where the nation itself functions like a single business corporation. This is appropriate technology that would have made E. F. Schumacher smile. —Richard Nilsen

Managing Tropical Biodiversity

Audiocassette by Daniel Janzen, 1991.

\$7 postpaid from California Academy of Sciences/Special Programs, Golden Gate Park, San Francisco, CA 94118

• The question many of us are thinking about today is: How do we conserve tropical biodiversity, so that it's still here, a hundred, a thousand, ten thousand years from now? The real answer to that question is: By using it.

• A real national park is so thoroughly entwined with the society around it that you can't even define the boundaries. That's the way conservation areas have to become.

• Take the gross national product of Costa Rica and divide it by the number of people and you come out with \$1,500. Do the same trick for the United States and you come out with \$15,000 — a tenfold in-

crease. There is no way in the world that you are going to make Costa Rica produce ten times what it produces today. You are not going to go into a country whose national budget is the size of an ordinary US university, and ask it to come up with a tenfold increase in the management costs of its wild areas, and sustain that out of its national budget. The money has to come from somewhere else. It's also not going to come from the people in this room, or many, many other rooms like it. Those parks have to become self-sustaining.

• How do you figure out what you've got in a short enough time so you can put that "what you've got" to work in a manner that will start auto-financing those conservation areas or (to use the old word) national parks?

• Notice I'm not saying we go out and we inventory the species in Costa Rica because we are worried about species loss. We're not worried about how many there are or what they are before they go extinct. We're talking pragmatically now — I've a warehouse with half a million things in it, and I don't have the foggiest idea what they are. How can I put them to work if I don't know what they are?

• This is the first bar-coded insect collection in the world. The data on each specimen label automatically goes into the computer at the time the label's put on it. So from the very beginning this mass of literally millions and millions of specimens ends up being completely organized. It seems

so obvious: why even bother to mention it? Well, the entomological world is still back there in Victorian England somewhere, about the year 1860.

• Go back to our corporation analogy: We are a corporation; we're specialized at one thing. We've got big greenhouses with lots of stuff in them, and now we know where the stuff is. So we stand at the door of the greenhouse, and we put our hands up and we say, "Hey, we want to go into joint venture activities with whoever."

• This morning Merck, the big pharmaceutical company, just signed a half-million-dollar contract with Costa Rica's National Biodiversity Institute. Fifty thousand dollars a year of that half million goes straight into the operating budget of one of those national parks, and the rest is used for training, and collecting the actual samples.

Every single sample that goes to Merck has got a lifetime royalty clause, so that if there is a commercialization, those royalties come back into the country of Costa Rica and are applied to conservation-area budgets in the country.

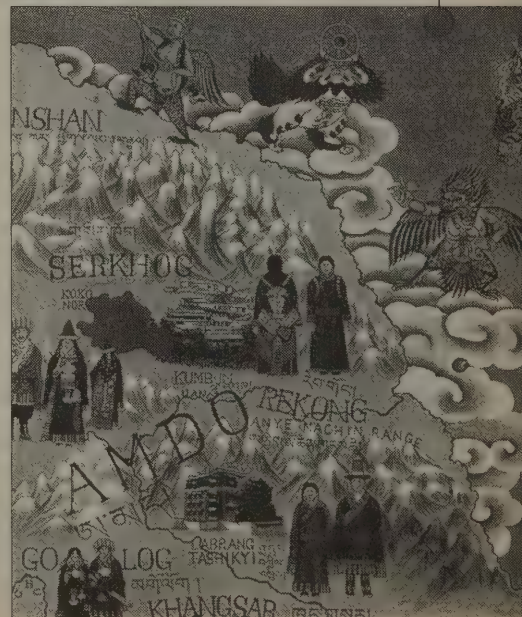
Guess what the selling point was. The bar code! The silly little bar code off a package of Oreo cookies in a supermarket. That made the difference. That's what caused Merck to look and realize they were dealing with an organized system, instead of somebody who gets off the boat from Brazil with a big gunny sack full of leaves and dumps them out and says, "Here, let's look and find something interesting." Well,

The Illustrated Map of Tibet

Because of its inaccessibility and, more recently, its political repression, Tibet has been a rather large blank space on the map for a long time. Here is a large, colorful Tibetan-made cross between a map and a poster that remedies the situation (see back cover). It names regions and locates cities and monasteries, and also shows regional costumes and wildlife. Also through its isolation, Tibet is a treasure house of Buddhist learning; floating off to one side of this map are monks, demons and deities. Can you think of any other map that includes a picture of a yeti? —Richard Nilsen

The Illustrated Map of Tibet
(40 1/2" x 22 1/2")

\$10 postpaid from The Office of Tibet/
Chimi Wangdu, 241 E. 32nd Street,
New York, NY 10016; 212/213-5010



maybe Merck does find something interesting in there. But then when they go back and say, "This is fantastic, let's get some more," the guy says, "Oh God, that was two hundred miles up the Amazon Basin, and they were shooting arrows at me — oh, no way!"

What we're talking about now is an organized inventory in an organized warehouse where you can go back and reliably get whatever it is you want for whoever is the commercial partner. When you talk that way, building those costs (which for us are a very large amount of management money) into their research budgets, it is very do-able.

To give you some concrete feeling for this, the research budget for one lousy drug today is roughly \$200 million. And a company like Merck won't even start that process unless they think they're looking at a billion dollars a year net sales.

Now for an academic biologist like me, I spend my life worrying about \$2,000 from here and \$1,000 from there. Those kinds of development costs are not even conceivable; they don't have any real meaning to me. But when I sit down and I look at the conservation areas of Costa Rica and I ask, "What does it cost to hire the people to run those areas correctly, what does it cost to run the Biodiversity Institute, and train those young curators and parataxonomists, and give them a working base?" I know I'm looking at fifteen-, twenty-, thirty-million-dollar-a-year budgets. Suddenly, I can't any longer think about how much money I can talk out of the National Science Foundation.

EarthSeals

A couple years ago, Paul Hoffman was living in his car in Berkeley. One night, an idea came to him with the kind of strength of conviction that William James called "noetic" — the idea that the earth's image ought to be distributed as stickers. He called NASA and confirmed his assumption that their photos of the Earth are public domain, raised a little money, and printed the first roll of EarthSeals. On the removable backing of each sticker was information (in nine languages) about how to get more stickers. EarthSeals now move as many as 200,000 a month.

You send your money, then Paul sends you the stickers you ordered (sometimes more), and includes literature about recycling, lists of the organizations that Paul thinks are helping to sustain life on the planet, etc. Some people buy his stickers, increase the price, and retail them. Some people get big rolls of them whenever they run into Paul Hoffman. Knowing the thrill of reeling off a dozen or a hundred, I understand the satisfaction of laying entire rolls on people.

Here's a fellow who brainstormed on an appropriate scale, grew it into a benign and thriving niche in the media ecology, and had fun all along the way. When you see an image of the earth in an unlikely public place, in odd corners of the world, think of an idea that comes to you one night, living in your car.
—Howard Rheingold

EarthSeals

Apollo 17(E)
\$3/6 stickers;
\$27/200; \$102/1,000
from P. O. Box 8000,
Berkeley, CA 94707

Woodworkers Alliance for Rainforest Protection

This small group of woodcrafters is discovering whether it is possible to dance an appropriately sustainable jig on the edge of a very sharp chisel. Like all of us, they are prime consumers of disappearing raw materials — in this case, tropical hardwoods. Like few of us, they are learning how to use these resources in ways that sustain their own livelihoods and provide income for their suppliers, and also sustain the resource they depend upon.

A big part of the task involves consumer education, and their newsletter *Understory* follows news from the woodshop to the international conference arena to the rainforest. They are also shop-testing underutilized hardwood species, but this is not a group out to identify the next fad tropical hardwood that will then

follow rosewood and mahogany into overcut scarcity. They are trying to figure out how to use the whole forest as forest, sustainably. — Richard Nilsen

• 5 Ways You Can Help Protect the Rainforest

1. Use less wood and choose it carefully. Use veneer instead of solid wood and look for certified woods from well-managed forests or plantations. Avoid seriously depleted species.

2. Experiment with lesser-known species. Hundreds of beautiful tropical timbers have barely been tested. Their use can bring more value to the forest and to the people who manage it responsibly.

3. Use recycled wood. Look for old buildings slated for demolition as well as packing

crates and pallets, many of which are made of tropical hardwoods.

4. Plant a tree. An increase in resources anywhere reduces pressure on resources everywhere.

5. Join WARP! The Woodworkers Alliance for Rainforest Protection is dedicated to sustainable development of our forest resources and provides reliable information about responsible timber management and wood use.

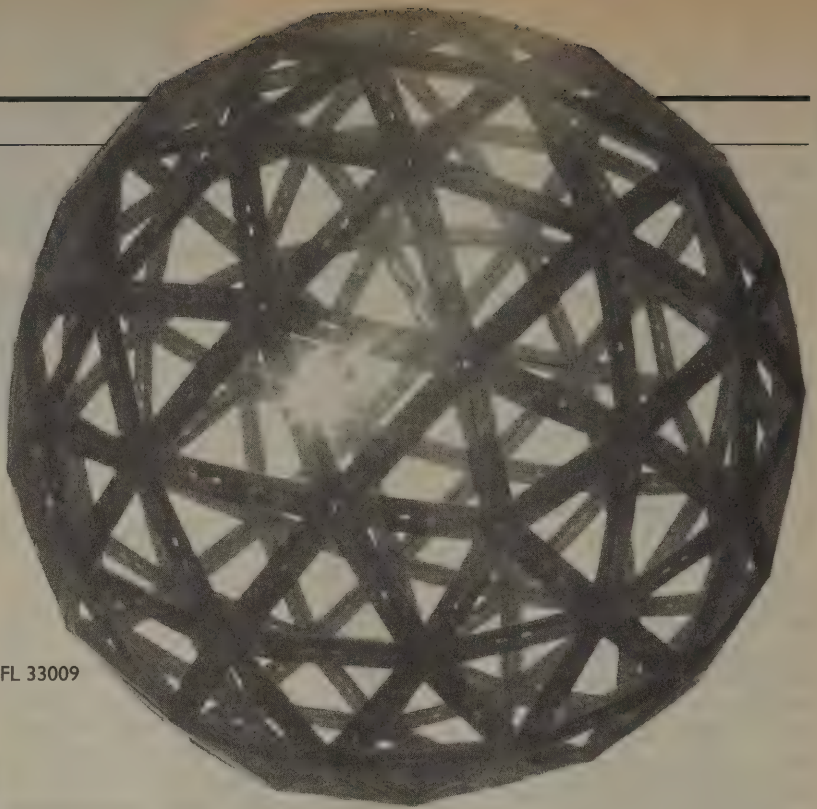
Woodworkers Alliance for Rainforest Protection

Membership

\$20/year (includes 4 issues of *Understory*; sample issue \$1) from WARP, Box 133, Coos Bay, OR 97420

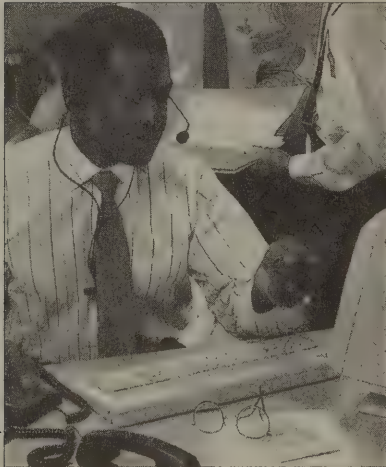
1.2.3.4. Sphere

This 21-inch-diameter object is the most aesthetically satisfying, available geodesic model I've yet seen marketed. It's made of thin, white card stock that is surprisingly resistant to disaster. That's just as well because assembly requires you to meticulously punch out the zillion pre-scored little parts, fold them appropriately, and then do an assembly act that requires the skills and patience of Fifty-Fingered Frank, especially as you near completion. Spiffy, though; when hung, it remains commendably spherical without baggy distortions. You can also make it up as separate domes. —J. Baldwin



1.2.3.4. Sphere

\$28.70 postpaid from A.G.S. Products,
2111 Southwest 31st Avenue, Pembroke Park, FL 33009



Hello Direct

This is where you get those telephones that you wear on your head so you can work with your hands while you gab (or gnash on hold). There is a suggestive array of other telephonish items too. Catalogs of this sort are a good place to learn what is available, especially if

you are not familiar with the field. Thus inspired, you may be able to use some of the equipment in ways never imagined by the inventors or vendor. —J. Baldwin

Hello Direct

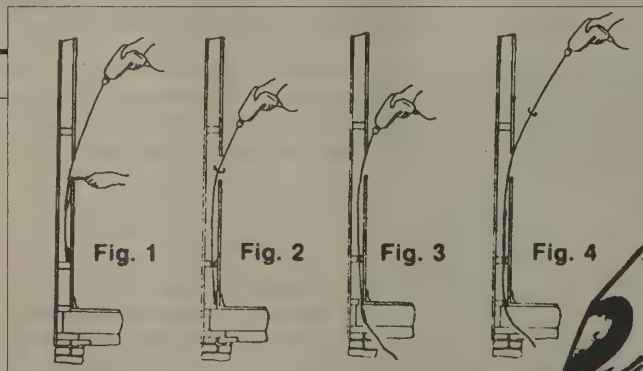
Catalog free from 140 Great Oaks Boulevard, San Jose, CA 95119; 800/444-3556

ITEM #	PRODUCT DESCRIPTION	1 - 5
1333U	Ultralight	\$169.00

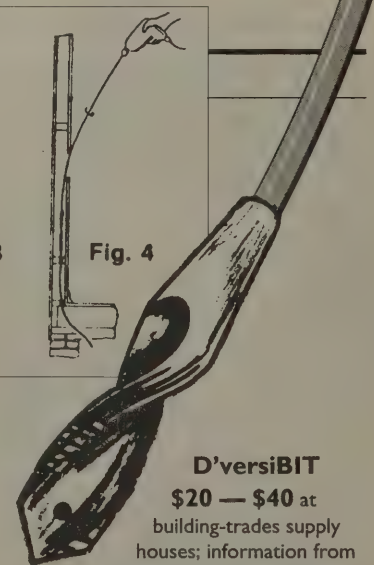
D'versiBIT[®]

Ever try to install a wire inside an existing wall you didn't want to damage?

The holes come out at the wrong places, right? And like as not, there is also a purlin in there that must be drilled. Even if you manage to make that hole, inducing preternaturally insolent wire to enter it and continue to the desired destination is an exercise in mouth-foaming frustration. Rather than indulging yourself in a bit of fire-ax work and its financial consequences, try one of these clever, six-foot-long, whippy and springy drill bits. They come in several types, including for concrete block. The business end has a hole in it so you can attach the wire and pull it back through your nicely aligned holes as you remove the bit. It all works just fine, though it takes a bit of practice



and patience to learn the technique of using the things in a way that doesn't invite a fatal and expensive SNAP! somewhere deep in the wall. Once mastered — not hard if you follow the included instructions — a D'versiBIT can greatly speed rewiring as well as reduce a tendency toward on-the-job assaults by the temporarily insane. —J. Baldwin



D'versiBIT

\$20 — \$40 at

building-trades supply houses; information from Diversified Manufacturing

& Marketing Co., 1207 Gant Road, Graham, NC 27253; 800/334-6870

Hexpertease

As kids fool around with these hex blocks they'll inevitably develop a feel for geometries other than the familiar rectangular. The process is helped along by suggestions for playing block-removing "collapse" games — a good way to gain understanding of (compression) structure. They're made of unfinished, unmanicured aspen. —J. Baldwin

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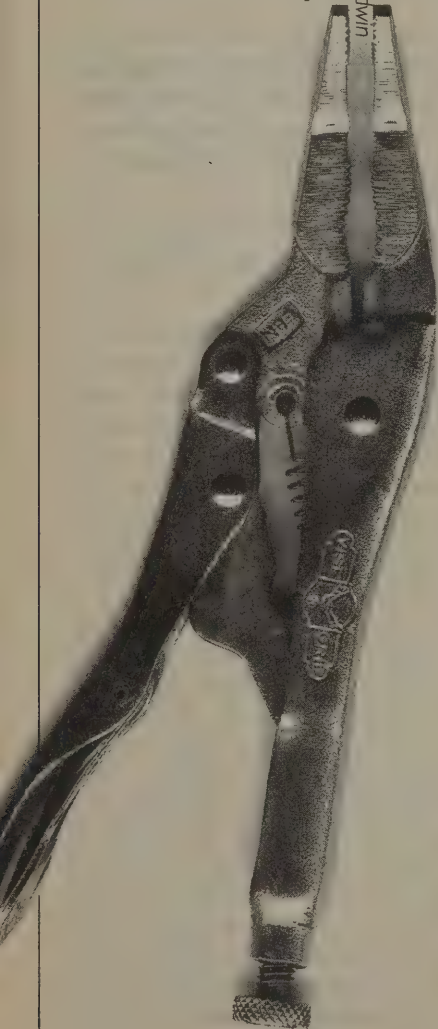
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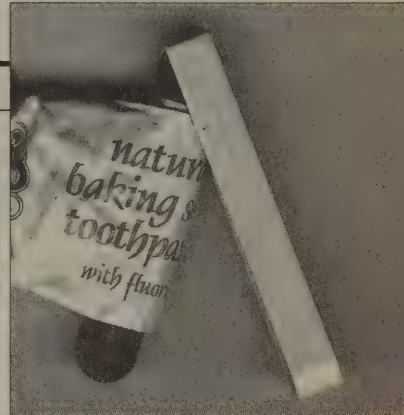


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omposing in the Information Age

BY CHRIS MEYER

THE OLD RULES DON'T APPLY ANY MORE. The explosion of the Information Age has erased many lines and blurred several others. Take for example how far a composer shapes the final form of a piece of music: In the past, the composer wrote a score, and handed it to others to perform. He or she might actually have conducted or performed one of the parts. Particularly in the areas of classical and jazz, conductors and musicians were encouraged to "interpret" the score. Today, some composers not only write all of the parts, but — with MIDI sequencers and multitrack recorders — perform all the parts. They may even have crafted some or all of the sounds from scratch, instead of relying on existing instruments.

The worlds of software and music have grown closer over the past few years. Not only is computer technology used extensively in the music-making and -recording processes, but creators in both fields share concerns about what happens to their work after it leaves their hands.

The following conversation on the impact of new technology and the "information age" on composers took place at the 1989 annual *Composer to Composer* symposium in Telluride, Colorado. John Lifton is a composer, futurist, and the codirector of the symposium. Chris Meyer is an instrument designer, multimedia standards activist, and writer for many music and electronics magazines. His email address is cybpunk@well.sf.ca.us. His log-in comes both from his car's vanity plates and his personal approach to life — high tech on the street level. —Jonathan E.

Some composers are willing to provide just the seed material for a series of chance operations or algorithmic-composition software. They may create the software themselves, coding into it a set of personal compositional rules, and consider that to be their "song." On top of this, a larger number of people call themselves "composers": computers, algorithmic composition, factory patches, and home studios have really opened the doors as to who can play. A lot of people don't play an instrument, or don't necessarily want to invest the effort into learning to play an instrument well, but it's getting easy for them to make music.

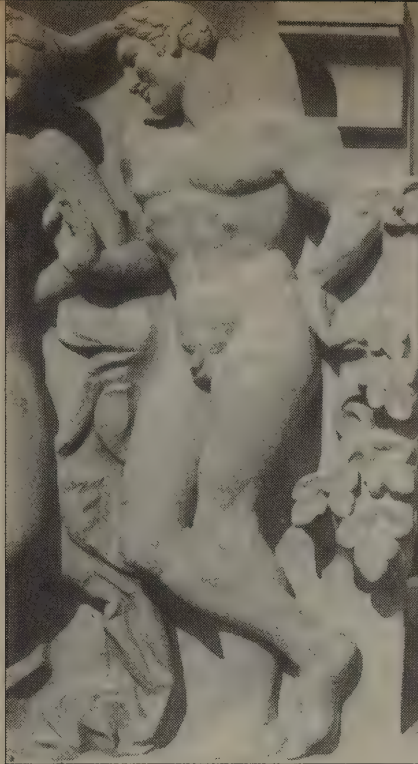
The tools that have given composers so much power and control (along with the choice of how much control to exert) have taken away the ability to keep sole possession of their work. With software so easily and so rampantly copied, sounds so readily sampled, and Standard MIDI Files around to encourage the capture and modification of another's musical sequence, how does a composer hope to make any money once his or her

work gets in the public's hands? These topics — the new relationships between composer and composition, and between creator and consumer — are discussed, if not necessarily resolved, herein.

CHRIS MEYER: How far does a composer's relationship with the composition go?

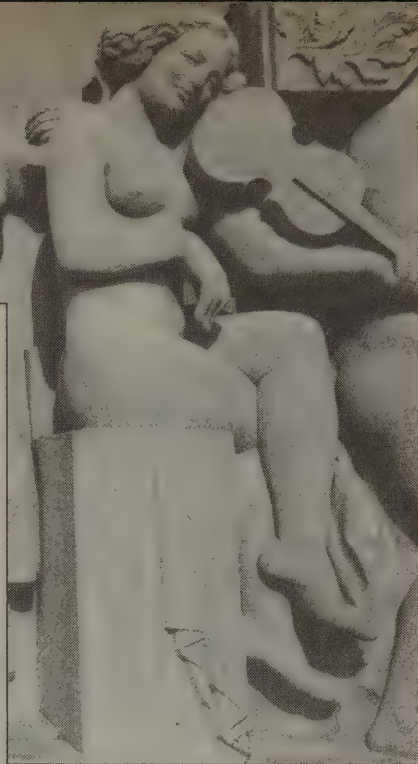
JOHN LIFTON: I don't think there's a real distinction any longer between the composition and the instrument and the means of dissemination and the means of reproduction. It's all one continuum of information.

CM: Two extremes seem to be represented by Laurie Spiegel and Paul DeMarinis: Laurie is willing to let some compositional rules be embodied in a piece of software, and let that live as a composition (namely, her program *Music Mouse*), whereas Paul defines every part of his compositions — what pieces of speech he samples to play back, and how he processes them with software and hardware he created. Every single part of it has to be defined to be the finished composition he had in his mind. It's no longer a question of turning out a score; it seems to be a question of how much of the final product a composer wants to have



**"It's one of the
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being any knowledge
about it."**

—John Lifton



control over. They're saying, "This much has to be hard-defined to convey my idea. And from there, whatever room's left, is up to you. But this is how much I wanted to define to get my idea across." Yet with things like MIDI and sampling, the composer may still not have control over what the listener ultimately hears.

JL: There are whole new areas of distinctions. And there are some new areas of concerns — organizations such as BMI are just scratching the surface about sampling and so on. But sampling, to my mind, is nothing compared with the biggest scale of the problem. The fact is that with music today, as with most software, the original piece costs a fortune, and all the rest costs nothing. The cost of reproduction or dissemination is almost nothing, and once it's out, it's out — effectively, there is no private domain.

The French theorists on postmodernism have described this vast expansion in the sense of "public space" and what constitutes public space within the culture. Effectively, once a piece has been put into that public arena it's gone, because it can be taken, it can be copied, it can be transformed, and there's not much you can do about it. In terms of the

conventional view of getting royalties for performance of work, it's a lost battle immediately.

The underlying problem is more a problem of economics — although economists don't seem to be prepared to address it. In the Industrial Society, when you produce a good — say you're producing toasters; it doesn't matter what it is — every one you produce takes the same amount of materials, and labor, and energy, and "stuff" as the one before, so you've got this certain, fixed cost. And up front, you've got R&D costs, etc. As you go on producing these things, the value of them is maintained, because each one costs that amount. At a certain point, you write off all of your up-front costs, but you've still got this unit cost you're dealing with.

Information products — copies of music, or software, or just raw data — aren't like industrial goods. The first one costs a fortune, and the rest are close to being free.

CM: It's a grossly distorted curve of normal production — the R&D is extraordinarily expensive, and the parts cost is very low. It's tricky — how do you amortize your R&D over one unit of product?

JL: And the form of the product is also variable [*floppy disk, data on a bulletin board network, etc.*]. But the whole way in which our economy works is geared towards the industrial model. So everybody's trying to sell information products as though they were toasters!

I'm amazed how well it's working — currently people are buying pieces of software like they were toasters. At the same time, there's this kind of "public domain" software building up, where there's a vast amount of material available that's almost free.

CM: And the medium is so easy to

copy — people have enormous banks of software that they copy from other people. But they don't have any of the manuals, and therefore don't know how to use most of it!

JL: Well, part of the answer to this is you give away the software and you sell the manuals. And you make your manuals so big that it's not worth trying to photocopy them [laughs]. I

suspect that the software houses are aware of that approach; that's one reason the manuals are so messy. There's protection in massive manuals. . . .

Another curious thing is that if you replace your computer, you can resell your old computer. But try and resell software — software is effectively, in one manner or another, licensed to the first purchaser. There's no resale market at all.

CM: If Laurie Spiegel gave away a composition that was recorded on a computer disk, what would she sell to recoup her production expenses? The "correct" patches on the synthesizer that fills out her piece for her? But then, those are so easily copied too. . . .

JL: This becomes more of a problem with sophisticated software. Because when the software itself embodies intelligence or expert skills, they're there regardless of the manual.

I really don't know what the answer is. Part of the problem is the whole way in which we look at economic value — it's going to have to change to deal with the Information Society.

CM: That's one thing that really scares me — no one has any answers, or can see an easy one right now.

JL: But if you look back at the beginning of industrialization, or of other major socioeconomic shifts, it's always like that for a while. You realize things are changing massively, but it's very hard to get a grip on them, and to see how it's going to pan out.

CM: So, this "middle period" — until we get a grip on it — is going to be a real rough time for people who are trying to make a living off any medium that can be distributed electronically.

JL: It could be. For composers who don't perform, there are some real risks. I think one way for composers to deal with this situation is to perform their work. There's a market for the performance which is independent, and which should hold value. I would encourage composers to get into performance. It's incredibly good

Chris Meyer



Mesa Z

ONE OF JOHN LIFTON'S current projects is designing a new community, to be called "Mesa Z." In John's words, "We see a massive decentralization starting to happen. For a lot of people, they could be living anywhere. With telecommunications, they don't need to be in urban centers with all the attendant problems. We want to provide to every lot, as a utility, worldwide communications. By extensions of the building code, just like having power outlets in every room, you have information outlets. Throughout the project, you can plug in your television, your telephone, your personal computer, your fax machine — and you're connected into this information network."

The master connection will most likely be to the Denver Teleport, which has line-of-sight connection to European and Pacific Rim geostationary satellites (and good linkage to South America).

Mesa Z will include about 740 units, with a final population of about 2,000. "We're planning to have passive solar earth-sheltered architecture throughout. New glazing technologies have given earth-sheltered building a whole new burst of life. In fact, we just completed a prototype building which looks as though it will be 100 percent solar, year-round, in this climate (the mountains of Colorado). Prototypes are under construction, with major building to start in "a couple of years or so."

The mesa where Mesa Z is located (a few miles outside Telluride, Colorado) stands a thousand feet above a half-mile-wide glacial valley. "As you come up the other side, there's another mesa, and then we have 14,000-foot peaks rising up from it. It's just spectacular." ☺

for composers, too. You can easily get too detached. It's really important, I think, to perform.

CM: And a performance — with the composer on hand to explain the work about to be heard — is a way to add value to a piece of music. It's sort of like manuals for music — some music seems to be better understood, or appreciated, if you read a text that explains it or have it explained to you in person by the composer at a concert. But one of my favorite questions is: "Is that cheating? Should the music be able to fully convey on its own what it's up to?" For me, the purpose of a particular composition can be either important research toward opening up a new area in music, an attempt at an artistic landmark, or something to please people. I think people who attend performances tend to think the object of music is to entertain.

JL: Well, I take the entertainment aspect very seriously. I hope I'm not implying that I take a snobbish position about this, and play down the entertainment. What I'd rather question is what we mean by "entertainment" — what are people's expectations and goals in terms of how they want to be entertained? There's more to it than simple entertainment, as there is with most of the arts — there are serious aesthetic purposes which are also tangled up with sensuality and the entertainment issues.

On the other hand, I think it's one of the unfortunate legacies of the Romantic movement in the last century that people feel that art should be immediate, and understandable, and have power and value, without there being any knowledge about it. To anybody before the mid-1800s, or even 1900, that would have seemed ludicrous, but most people seem to be working with that assumption. And they substitute the kind of knowledge or understanding that's needed with familiarity. You get used to certain forms, and you can recognize other things — it becomes

kind of a language issue. But it doesn't actually connect you with any deeper-level structure.

CM: I think of computer music as one of the main areas that used to require explanation, or at least understanding, on a different level than "entertainment only." But now, musicians have computers in their homes. . . .

JL: Computer music has been throttled by the grip of academia. For a long time, almost all of the computer music that was being done was being done in academic areas by a very small group of people who

were basically teachers. They're composers, but they're not primarily composers.

But things are changing rapidly. Suddenly enormous numbers of people are composing with computers, working in the areas we've discussed, and dealing with these problems. And maybe they're not so serious; maybe it's sort of amateur, but it alters the whole arena when that happens. And that's what I see — the shape of the arena and who's viewing it has changed drastically. ☺

Amplified Harmonica Playing Made Possible

Agghh! Here he comes again: the tin-eared old hippie who lurks in the parking lot adjacent to our hutlike office, fecklessly honking his Marine Band without regard for tune or timbre. Some day soon I'm going to throw this book over the fence at him, possibly wrapped around a half-brick.

*Since the mechanics of harp-playing are largely invisible (what is observable is mostly histrionic), it would seem more than usually difficult for a book to convey harmonica technique. **Amplified Harmonica** does so startlingly well, in few words and with considerable charm. While much of it is indeed specifically about electric harp, I would recommend it as a pan-harmonica primer and reference that nascent Musselwhites will be slow to outgrow. —James Donnelly*

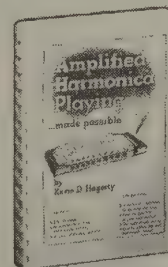
■ What you now hold in your hands is a special-effects device. The sound-box that your hands now form, when cupped around the harp, allows you to create all kinds of sounds and tones. If you keep your hands cupped together tightly, you close down the hollow place that your two hands create, giving your playing a muffled, bassy tone. If you lift the pinky end of your left hand off of the right hand, while you keep a grip on the front of the harp, you open up that same space, and your two hands form a kind of megaphone, giving your playing a loud, piercing, trebly sound. By repeating this open-and-shut procedure, you can get warbles, vibrato, all kinds of variations, which we'll go into in detail in the "riffs" chapter, later on.

■ **Chromatic Impersonation**

This is a riff which I've heard very in-

frequently. It sounds like the person playing has suddenly switched from playing a Marine Band to a chromatic, right in the middle of a song. It's an eerie effect, maybe because it makes your playing sound like you're a million miles away, and it's very dramatic when played amplified. You can hear Little Walter playing this riff on his recording "Off The Wall," at the quiet part right before the end of the song.

To play this way, have your jaw and tongue in position to produce your bassiest tone. Play very softly, with a minimum of breath, so that the reeds barely even ring at all. It requires a lot of breath control, but if you do it just right, you almost can't be heard, but you pick up a harmonic overtone to your playing. Guitarists use harmonics (not harmonicas) as a way to play two notes simultaneously on one string. You are doing it on one reed, and it sounds wild when you master it.



Amplified Harmonica Playing Made Possible

Kevin D. Hagerty, 1991; 69 pp.

\$7.95 (\$9.95 postpaid) from Potential Publications, 23 School Street, Brunswick, ME 04011

MUSICAL

MIGRATIONS

BY JONATHAN E.

BAY BEATS

The San Francisco Bay Area is well known for its contributions to music, both 25 years ago and today for its currently booming rock scene. It also has a substantial community of musicians working in less commercial genres who, for the most part, receive only limited local attention. Several have recently released noteworthy albums that are hard to find in your local store, even in the Bay Area.

The way the Jamaican ska sound of almost thirty years ago has taken root on the California coast and a few other strongholds, flourished and mutated while adapting to local conditions and times, is a fascinating phenomenon. **Square Roots** is only one of more contemporary ska groups than I can keep up with. Really it's a bit of a misnomer to tag the band as ska: they perform original songs in a style that is ska-based, but is also reggae-inflected and rap-tinged. There's a lot of youthful humor here — generally the approach is a bit raucously party-oriented — but there's also a sly, ironic intelligence with a dose of social consciousness at work in the lyrics. That intelligence is also apparent in the music. The styles are well put together, with some songs amalgamating several elements and some being stylistically straight-ahead. (Cassette \$8, CD \$12 postpaid from Square Roots, P. O. Box 1966, Aptos, CA 95001; 408/462-6791.)



Claudia Gomez

With a name like **The Dub Addxx** you'd expect the sound to be at the dub end of the spectrum — and so it is, somewhere between **Augustus Pablo** and **Adrian Sherwood**. *Dub To The Truthseekers* has a measured stateliness and elegance with a steely core of sinewy strength. The boundaries of the music nudge up against the jazzy sounds of pre-reggae Jamaican instrumental styles, and there's a hint of the Caribbean-Latin interface. It's all very classy and classic, complete with a real horn section. (Cassette \$10, CD \$12, and (gasp!) vinyl LP \$10 postpaid from Black Matrix Sounds, P. O. Box 410181, San Francisco, CA 94141; 415/861-8394.)

The groove of **Jungular Grooves** is generally in the funky reggae bag, but *International Soul* is the name of their album and their preferred tag. The music is anchored by muscular bass and sensitive drumming with shimmering steel pan, stinging lead guitar, and a sax that honks, squeals and soars like a wild bird, all artfully arranged on top. **Reggie Benn's** vocals are particularly pleasant. His voice is somewhat reminiscent of **Roland Gift's**, but has an edge and resonance that sets him apart. What makes everything shine and hang together so well is the excellent songwriting. There's imagination and grace abundant on every track. (Available from Round World; CD only.)

The music on *Salamandra* by **Claudia Gomez** comes from Brazil, Cuba, and Colombia and is on the quiet, acoustic side. There are a couple of fiery percussion tracks, but overall the mood is delicate and airy. I find it most refreshing. The recording is one of those audiophile live-and-direct-to-two-mics affairs, so you're hearing what these folks did live in the studio — although in a couple of places there were too many musicians for the size of the room, resulting in a slightly confused sound. It will be a problem for only the most dedicated audiophiles. (CD only; \$20 postpaid plus CA sales tax from Clarity Recordings, P. O. Box 411407, San Francisco, CA 94141-1407; 415/626-7540.)



Remmy Ongala and Orchestre Super Matimila

AFRICA AFAR

Yousou N'Dour relaunches his international career with *Eyes Open* (40 Acres & A Mule). Yousou has caused despair in the hearts of African music fans with his Westernized releases for the international market, while Africa gets the "real" stuff on mostly unavailable cassettes. *Eyes Open* is reportedly the same for both markets, but is still not uniformly in the style that originally brought him to prominence. This is the work of an older, more mature artist who is determined to communicate globally. Some lyrics are in English (all are translated in the booklet with Yousou's explanations of the cultural context); they address issues that have resonance everywhere — the role of TV, rural migration to the cities, population control, and the proliferation of weapons while people go hungry. The music is equally expansive but still recognizably Senegalese in origin, and every track is hard-hitting whether it be a ballad, a jazzy groove or a close-to-the-roots Senegalese workout. Even diehard African purists have applauded this recording, although if you listen to it next to *Immigres*, his first breakthrough to the West and most definitely African, you'll

BRAZILIAN BONUS

By **Sergio Mendes'** reputation, *Brasileiro* (Elektra) wouldn't be an album to get excited about — but it's an astoundingly wonderful creation, combining incredibly heavy-duty percussion with group chanting, individual and seductive rap, and infectious pop charm. There are also some real interesting sounds from Sergio's synthesized brass. The styles explored range from samba-reggae through forro to swinging jazz, with several more obscure ones along the way. The moods created vary similarly, but there's no doubt about the music's Brazilian inspiration or its international outlook. **Chris McGowan's** sleeve notes deserve

hear a different musical approach. What makes both work is Youssou's glorious voice riding one of the world's great musical chariots, **The Super Étoile** band.

Remmy Ongala and Orchestre Super Matimila come from Tanzania, diagonally across the continent from Senegal. *Mambo* (RealWorld) is their third international release (see *WER #67*, p. 90 for a review of *Songs For The Poor Man*). Remmy also tackles issues of international scope, such as the rural-urban migration and the resulting cash economy, AIDS, and global unification, with some lyrics in English but most in Swahili. However, Remmy concentrates a little more on the home situation than Youssou. Appropriately, the music remains closer to its soukous origins than Youssou's does to its mbalax roots, with a simpler line-up of guitars (four of them), bass, and kit drums. It is amazingly joyous and energetic, defiant even — given its somber subject matter — dramatically illustrating the power of music to help the listener transcend the woes of the world.

Those who have heard **Ismael Lo's** previous import albums complain that he is recycling his melodies. However his self-titled and first US release (*Mango*) should please new listeners with its calm and reflective beauty and gently moving pace. His voice is attractively yearning, while his music has a folky feel that manages to include a rich blend of Latin-jazz and Spanish classical influences as well as a full horn section and electronic atmospherics.

special notice for their educational content. Forget about Sergio's past and listen to this record — it's one of the most surprising musical achievements of the past few years.

Kele Mou Bana, from **Don Pullen & The African-Brazilian Connection** (Blue Note), is an impressive demonstration of the links between American jazz and the musics of Africa and Brazil. Incendiary, cascading piano joins with wide-ranging sax to explore the outer limits of melody with the steady support of bass and the pyrotechnics of percussive propulsion. The mood



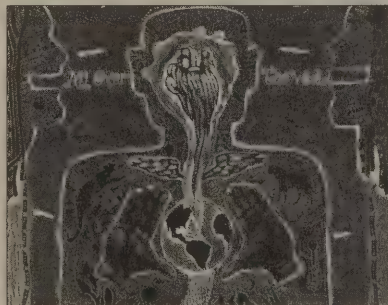
Sergio Mendes

goes from intensely frenetic to swingingly relaxed with a few moments of delicacy, but the interaction of these players and their ideas is constantly exciting. The sense of motion never lets up.

REGGAE REARRANGEMENT

Peeni Waali (Shanachie) is a bizarre but enchanting Swiss production featuring some of reggae's greatest names — **Linton Kwesi Johnson, Lee Perry, Rico**, and assorted others — plus **The Horns of Liechtenstein**. The music slides from dub poetry to Arabic chanting to Celtic jigs to jazzy swing to hard rock guitar. Somehow the transitions work just fine, comfortably transporting the listener on a magic carpet over a fantasy musical landscape.

Edward II also stretches the bounds of reggae with a Celtic flavor, polka jumpiness, and a Two-Tone-influenced



The Wailing Souls

multicultural funky attitude. *Wicked Men* (Rhythm Safari) bounds from one side of this musical universe to the other, but each track hangs together in a cohesive style even when exploring several influences at the same time. The material includes touching love songs and jump-up dance numbers, but outstanding is "Real World," which explores the relationship of movie and television violence to the real world.

The Wailing Souls have been around for a long time and are best known for their vocal harmonies and high-quality but straight-ahead reggae. *All Over The World* (Chaos) will shock their old fans with some of its hard-hitting, massively pop-oriented, rap-influenced dancehall tracks. However, it's extremely well produced, much of it is less massaged, and their message of peace and justice remains the same — perhaps it will now spread a little further. In addition they do a remake of "Sweet Black Angel" that is exemplary for its additions to previous versions while retaining the charm of the song. 🗨

All releases, except those with their own access, are available on CD for \$18 each or cassette for \$11 each (postpaid) from Round World Music, 491A Guerrero, San Francisco, CA 94110; 415/255-8411.

Managing the Desktop Revolution

BY DAN SNODDERLY

D

ESKTOP PUBLISHING (DTP) has brought with it a host of disadvantages along with its many advantages. It is an excellent example of one of Murphy's laws, "Every solution creates a new problem."

There's more to every tool than meets the eye. Some tools, especially many computer-based tools, are as likely to sink your business as streamline it, if you don't know the pitfalls.

Dan Snodderly has worked with desktop publishing systems at three publishers. Herein he shares some of that hard-won knowledge. He offered this piece to us some time ago; we sat on our hands, and he sold it elsewhere: we now reprint it from Publishers Weekly and Communication News.

Snodderly, formerly an editor at Cornell University Press and elsewhere, is an editor at the United States Institute of Peace in Washington, DC.

—Howard Rheingold

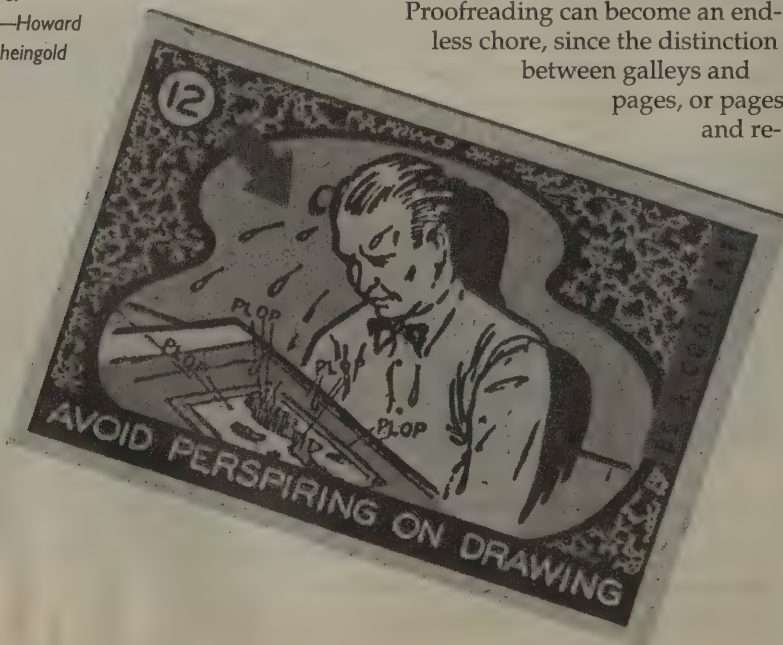
On the plus side, DTP has allowed publishers to bring much more of the production process inhouse; in theory, this gives them more control of the process and allows them to save time and money. In practice, bringing the process inhouse can have the opposite effect. The publications manager can no longer intimidate the front office by invoking the mysterious rituals of the out-of-house printer, whose schedules are inflexible and who charges much more for delays. Administrators now understand that the DTP operator is, most likely, the secretary down the hall, so they worry less about giving advance warning or keeping to deadlines. After all, "Sally is right here" and "these changes won't take a minute." It thus becomes harder and harder for the DTP manager to say no.

Proofreading can become an endless chore, since the distinction between galleys and pages, or pages and re-

vised pages, has virtually disappeared. Indeed, fifth or sixth revisions are not uncommon, and some people mark their proofs with the exact time (2:50, 3:10). Not only do editors have to read more stages of proof; they also have to read more text at each stage, since it's often not clear how much of the corrected text was rerun. Furthermore, the final phase — fine-tuning the layout (aligning columns, changing type size, fixing bad breaks, and so forth) — can be remarkably frustrating, since each change often creates new problems. As a result, the actual cost of producing a publication may be greater with DTP. Most publishers have no idea of the real cost, since they never figure staff time into the equation.

Managing publication flow also can become more difficult, because the DTP operator's time will likely be taken over by desktop duties. Colleagues in other departments will discover that their announcements or reports look a lot better designed on desktop. Although they aren't willing to spend their own funds on a professional designer, "it sure would be nice if Sally could do something with this dull-looking piece. She's so good at it, and it won't take a minute."

Since DTP seems so quick and easy to the uninitiated, they have few qualms about dumping major new projects on the DTP department. Most people think that desktop software is just another form of word-processing software. They don't realize that



(Without Getting Guillotined)

desktop is a lot more complicated than WordPerfect or Microsoft Word. The price of the new technology is a steep learning curve.

And speaking of "Sally," she may be very excited about learning new skills and improving her marketability. That is terrific, except that it doesn't actually seem to be doing "Sally" much good. Desktop systems generally are run by secretaries, editorial assistants, or other lower-level, mostly female employees. What seems to happen is that they get new responsibilities without additional pay. Consequently there is a lot

I have said that DTP has many advantages, and that is true. You can save time, money, and certain kinds of aggravation by bringing portions of the production process inhouse. Besides, many publications departments have already spent \$10,000 on a desktop system, so it doesn't make sense not to use it.

What can managers do to make the best of the situation?

First, be skeptical about anything a computer consultant tells you; they tend to downplay the downside. To do what you want to do may cost you more money and time than it's worth. For example, it is possible to convert from IBM floppy disks to Macintosh floppies (and vice versa), but the process may be time-consuming, and the converter may not be able to read imbedded commands such as footnotes. You may need a consultant's advice, but you don't always have to take it.

Second, learn how to use your system. You'll be able to manage the process much better if you understand the basic capabilities and limitations of DTP, and the only way to do that is to use it. You'll also be able to make corrections yourself if someone else is out sick and the deadline is looming.

Third, acknowledge the fact that learning and using the desktop is

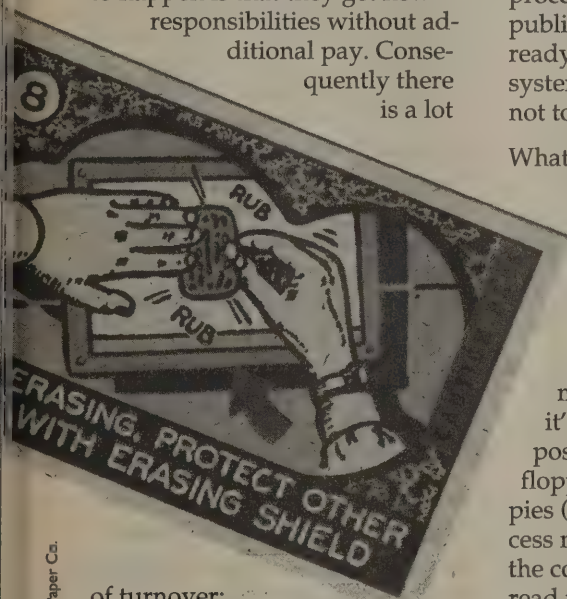
going to take a large amount of your department's time.

Allocate enough of your budget to get more than one staff member trained. Reorganize office duties to take account of the fact that at least one staff member will be spending a lot of time on desktop; indeed, you probably should rewrite that job description to upgrade the primary DTP position. (Nobody likes to take on personnel, but do you really want to train a new DTP operator every year?) Charge this extra expense against the typesetting costs you save.

Fourth, work hard to maintain the concept that page proofs are to be read for typographical corrections only. When you aren't successful, gently remind the offender that changes delay the process and increase costs.

Fifth, at least for major productions, insist on good design and printing, even if it takes more time and money. In particular, have your final camera-ready copy produced by a service bureau or professional typesetter. If you use a typical publications office's laser printer, you'll get a density of 300 dots per inch. A service bureau will probably use a Linotronic printer, which prints at about 1,300 dpi. The difference will be obvious to your readers, although they won't necessarily understand why.

Finally, try to have some fun doing it. After all, laughter is the best medicine (although brandy is also highly recommended). ☛



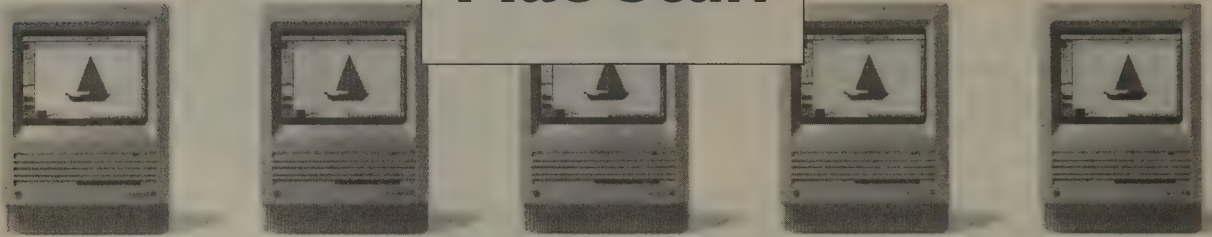
of turnover; managers are constantly training people to do DTP (which is, of course, very expensive).

And what about the quality? As good as "Sally" is, she is not a professional designer. Untrained DTP operators tend to overdesign a publication, using too many typefaces and design elements and not enough white space. It may well be that a lot of ephemera looks better now than before DTP, but it is also true that a lot of more substantial publications look worse.

BY ANDREW DICK

Good Cheap Mac Stuff

Andrew Dick caught computer flu from the original Mac 128. He admits to techno-lust in his heart, but swears by his upgraded Mac Plus.



THE MAC IS a wonderful computer that can help create or manage: information, art, business, words, etc. Be warned, however: MacLust is a virulent and infectious disease. It's not fatal, just maddening — prices can drop 100 percent in two years, but there's always something sensational *and* expensive coming out. Advertising hoopla obscures the fact that Macs can be inexpensive. You could publish the *Whole Earth Review* or run a small business with low-priced equipment — it won't be lightning-fast, but you'll save thousands of dollars.

Prices quoted are Street (as opposed to Manufacturer's Recommended). By the time you read this, hardware will probably be lower; software can go either way.

Hardware

Buying used computers is not particularly dicy. If a computer is gonna fail, it usually does so in the first six months. Two caveats: the Plus's power supply is weak; it needs an add-on fan. Monitors can "burn in" if left on all the time. However, the damage is easy to see and avoid.

COMPUTER Apple dumped the Plus and SE, but they're fine machines; unless you do color or sound, they can easily be upgraded to meet most needs. With upgrades, they'll run System 7 and all but the higher high-end programs. Used Pluses go for \$350, SEs for \$450 (add \$200 if they include 2.5 meg RAM and HDs). The Plus is slightly slower but will do 95 percent of what an SE or Classic will. However, the Plus is less expandable, and its power supply can blow. (Fixes cost \$125.)

The Classic, Apple's new low-end Mac (\$925 new with 4 megs RAM/40-meg HD) is better than the Plus

and SE it replaced, but not much. If you'll need muscle, get a Classic II (\$1,250 new with 4/40): it's a lot more computer.

MEMORY You *must* have a hard drive. If you buy new, insist on an HD with external termination and external SCSI switching. New 40-meg HDs cost about \$250. If (when you run out of HD space, Super-Disk (\$45 from Alysis: 800/825-9747) is an inexpensive and painless way to double the capacity of your HD. It's great software.

You'll also want at least 2.5 megs of RAM. The Plus and SE were shipped with 1 meg but can be upgraded to 2.5 or 4 megs. Do-it-yourself upgrades are easy, and cost \$90 for 2.5 megs and \$180 for 4 megs. Upgrades from Technology Works (800/879-9739) include a lifetime warranty and excellent support.

PRINTER Used ImageWriter IIs go

1. It's inconvenient, but you can get by without a printer — copy shops offer do-it-yourself laser printing for about 50¢ a page.

for \$165, but unless you're on a very tight budget or print multi-part forms, don't bother. Ink-jet printers give laserlike output at a fraction of the price. Apple's StyleWriter (\$325) and Hewlett-Packard's DeskWriter (\$350) are excellent.

If you print more than basic text, two pieces of software will make ink-jet output nearly indistinguishable from \$2,500 lasers. Adobe Type Manager (ATM) eliminates "jaggies" on skewed or odd-size text. It comes free with some programs² or you can buy it for \$60. Freedom

What

WHAT: If I was on a tight budget, I'd get a used SE or Plus — in that order. Otherwise, I'd get a Classic II. Whatever you buy, you need an HD and at least 2.5 megs of RAM.

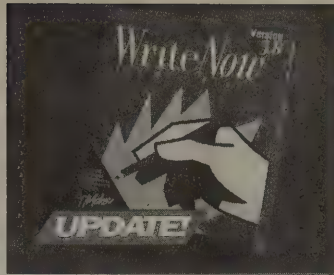
For software, you should first get the safety programs. It's hard to recommend other software without knowing your needs. (Buying used software is difficult — some programs won't run under System 6.0.7 or 7.0. Before buying, make sure it runs under both.) But for general use it's hard to beat integrated packages — if you need more power in one area, add a standalone program. However, if you're working in only

of the Press Lite (\$55 from Custom Applications: 508/667-8585) renders Postscript graphics (and text) on non-Postscript printers. It's slow and requires 2 megs RAM, but it's good.

Software

If you track orders against inventory, profits, and salespeople, get Double Helix; if you keep statistics on global warming, get Excel; if you publish magazines, get Quark. High-end programs like these get all the attention, but for most people they're like using a helicopter to go shopping. Modest programs don't require the hardware and hassle of premier applications, but will do the jobs most people actually require. If you outgrow an inexpensive program, you can move up and take your data with you. Except as noted, the following run with 1 meg under System 6.0.5. With 2.5 megs, they'll run under System 7.

2. Apple might include it with system software; if so, you can get it from user groups and BBSes. TrueType (free from Apple) does the same thing, but I recommend ATM.



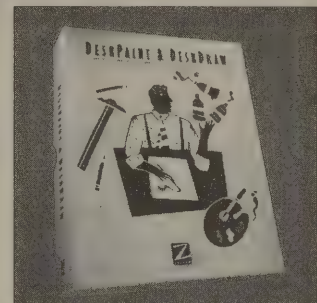
WORD PROCESSING WriteNow (\$155 from T/Maker: 415/962-0195) is software done right: clean, powerful, and fast. Taste (\$85 from DeltaPoint: 800/367-4334) isn't as elegant, but has a great price and lots of power: word processing, address book, and modest desktop publishing and graphics. (Requires 2 megs RAM.)

DATABASE Database (\$65 from Baseline: 901/682-9676) is a desk accessory (DA).³ Great for address books, but strong enough for bigger jobs. RecordHolder Plus (\$80 from Software Discoveries: 213/644-9225)

3. DAs are always available. With applications, you must exit the one you're in before you can open another. If you've got 2.5 megs of RAM, however, you can run Multifinder or System 7, where the distinction between applications and DAs essentially disappears.

is an application — not as convenient as a DA, but very capable. MyAdvancedDatabase (\$35 from MySoftware: 415/325-9372) lacks picture fields, but it's a powerful application and a great value.

SPREADSHEET Even at double the price, nothing comes close to Bi-Plane (\$60 from Night Diamonds: 714/842-2492; includes chart and DA). If you don't require a full-blown spreadsheet, One Shot Worksheet (\$45 from Baseline; includes chart and DA) is convenient and useful, and doubles as a presentation tool.



GRAPHICS For convenience, power, and price, you can't beat the DAs DeskPaint & Draw (\$110 from Zedcor: 602/881-8101). SuperPaint

and Where to Buy

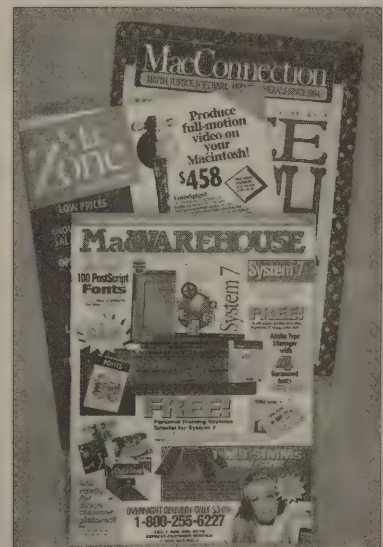
a couple of areas, it's probably best to get individual programs.

WHERE: Careful shopping can save big bucks. For commercial software, mail order is cheapest; MacWarehouse (800/255-6227), MacZone (800/248-0800), and MacConnection (800/334-4444) are reputable firms with excellent service. Get the catalogs; if you don't see something, ask. Also inquire about special offers and money-back guarantees before you order. For shareware, visit a user group (below) or bulletin-board system.

Apple and some other companies of-

fer educational discounts; if you're connected with a college or school district (or know someone who is), check this first. Mail order and "super stores" also offer good value. For used stuff, check the local classifieds, ads in Mac magazines, Boston Computer Exchange (800/262-6399), and user groups. (Call 800/538-9696, ext. 500, to locate a group near you.)

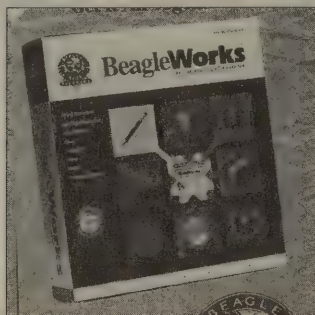
RESOURCES: MacUser (\$27/12 issues; 800/627-2247) and MacWorld (\$30/12 issues; 800/234-1038) are available on newsstands. Check their ads and reviews. BMUG (415/549-2684), a national user group, is an extraordinary resource. ☺



(\$132 from Aldus: 206/622-5500) is the most powerful application you can get for under \$250. (Requires 2 megs RAM.)

ACCOUNTING Quicken (\$45 from Intuit: 800/624-8742), MacMoney (\$55 from Survivor Software: 213/338-0155), and DacEasy Light (\$35 from DacEasy: 800/877-8088) are good for personal and small-business use.

DESKTOP PUBLISHING If Publish-It! Easy (\$145 from Timeworks: 800/323-7744) can't do the job, you need a bigger computer and a promotion. Personal Press (Aldus, \$120) is also very good — not as many features, but elegant and easy to use.



Integrated Packages

These have the basic applications (word processing, graphics, database, communications, spreadsheet, and chart). While they aren't always as powerful as standalone programs, packages offer amazing bang for the buck. Probably all many people will need.

BEAGLEWORKS (\$185 from Beagle Bros.: 619/452-5500) has the basics. Every module is always available, and products from each can exist in the same document and be automatically updated by "hot links." Good power, excellent integration. Superb!

CLARISWORKS (\$180 from Claris: 408/727-8227) has the basics and macros (which automate repetitive tasks). Beautiful interface, good integration, and discounted upgrades to standalone applications. (Communications requires 2 megs RAM.)

GREATWORKS (\$185 from Symantec: 800/441-7234.) has basics, plus outline. Not as tightly integrated, but a

What They Do

Word Processing: Write, edit freely, check spelling, hyphenate, and use the thesaurus. Good-looking copy with minimum hassle.

Databases: Organize and manipulate data. Search on various criteria (e.g. *List all contacts who are activists, live in NY or CA, and work in the arts*), calculate purchase orders, do form letters; keep notes, mailing lists, inventory, etc.

Spreadsheets: Crunch numbers and do "what-if" analysis (e.g. *We break even selling 9,000 widgets at \$7. What if we reduce expenses 2%?*). For finances and statistics. *Charting* turns the numbers into graphs.

Accounting: You enter the data; it does the rest of the work. Balance your books and produce budgets, tax, and financial reports. Helpful at home, necessary for business, a godsend at tax time.

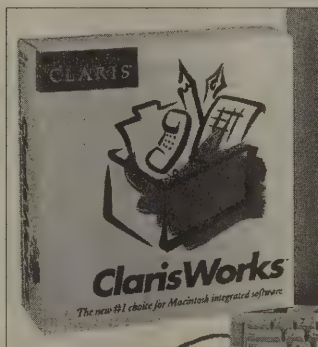
Graphics: Create (or import) graphics, then reverse, skew, distort, re-size (etc.) the results.

Desktop Publishing: Produce posters, newsletters, presentations, and books.

Miscellaneous: With a modem, *Communications* let you "talk" with other computers. *Outliners* are writing/presentation aids. *Reminders* track and remind you of events.

solid program from a good company. Frequently bundled with other useful programs.

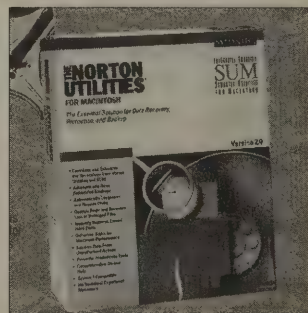
and HD space. As I write, Zedcor's selling it direct for under \$75: a tremendous value.



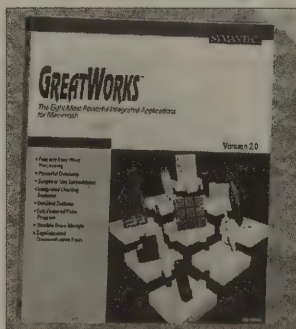
DESK (\$50-\$180 from Zedcor: 800/482-4567) has basics, plus reminders. While not as powerful as the above, Desk has advantages. The modules are DAs, so you can install just what you need, saving RAM

Safety

For virus protection, Disinfectant (freeware) is probably all you need. But if you're nervous, get SAM (\$65 from Symantec). Hard-disk backup is *critical*, and DiskFit Pro (\$75 from Dantz: 510/849-0293) is my favorite.

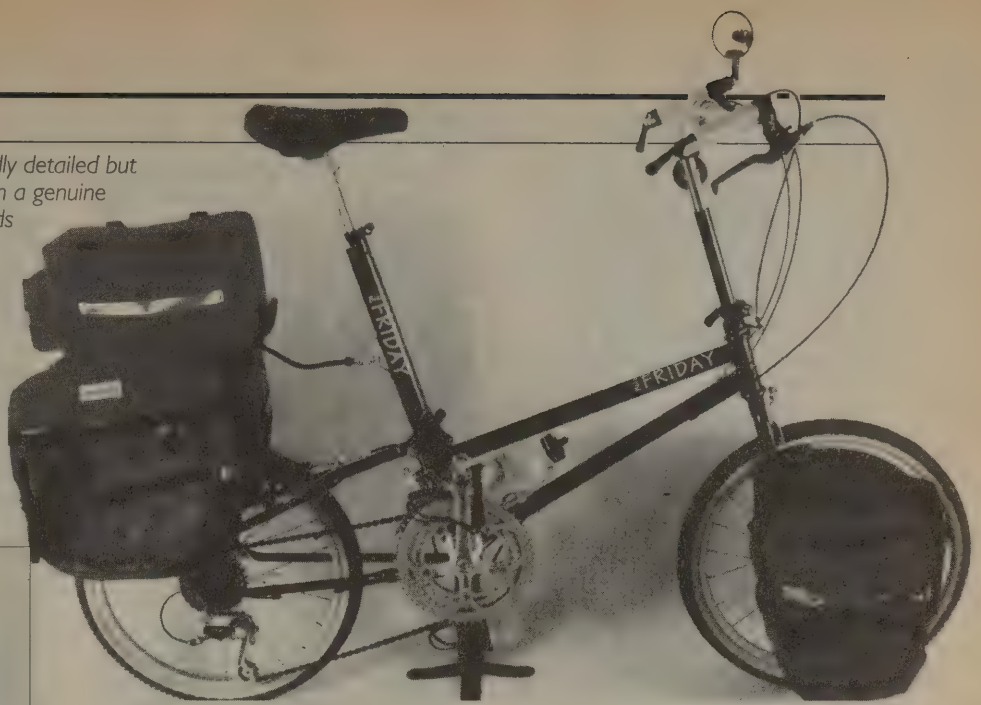


Disk utilities make life easier and can save you from disaster. Norton Utilities (\$85 from Symantec) and MacTools Deluxe (\$80 from Central Point: 800/445-0412) are excellent and include hard-disk backup. Screen savers prevent burn-in; I use AutoBlack, but dozens of other free/shareware programs will do the job. ☺



Bike Friday

This is a "real," strange-looking, oddly detailed but not freakish road bike that comes in a genuine Samsonite suitcase. It has 14 speeds and the usual features befitting a light (23.5 lbs or so) and useful steed. It is not a dinky "folder," though breakdown and setup take only a couple minutes. I have not ridden one yet; spies say it is respectable but not awe-inspiring. What's important is that you can now easily take a nice bike with you on the plane, boat or train



with no fear of hassle or destruction. Options permit a certain amount of customizing for your needs; there's even an accessory that converts the suitcase into a utility trailer! —J. Baldwin

Bike Friday \$749 - \$829

Information free from Green Gear Cycling, 4065 W. 11th Avenue #14, Eugene, OR 97402; 800/777-0258

Yankee Bicycle

For those who'd welcome a low-testosterone bike that's exceptionally easy to ride and manage in everyday urban use, this machine is hard to beat. The easy balance and mild performance may invite the sneers of serious roadies and mountain bikers, but make it possible and pleasurable for the easily intimidated to enjoy cycling around town on a decent machine. A unique, simple 9-speed expanding-chainwheel transmission makes gearshifting nearly foolproof. A light squeeze applies

the powerful brake (at the rear only — front brakes require skill not everyone can master). Amazingly, it stops even better when wet! Good materials are used throughout, though it would be nice to carve off a few of the rather pudgy 30 lbs.

by using a more esoteric (e.g., more expensive) frame material. It's reported to be selling well; I can see why. —J. Baldwin

Yankee Bicycle \$369

Information free from Yankee Bicycle Company, 1125 Carolina Drive, West Chicago, IL 60185; 800/858-2453



Yesterday's Houses of Tomorrow

Housebuilding remains the only major handcraft enterprise in our industrial society. Lacking the economic and performance advantages of mass production, but gaining little from on-site construction by the building trades, houses are unnecessarily expensive to buy and maintain. Virtually all are biodegradable — an undesirable feature. Basic technique is still eighteenth-century, but the problems have been recognized for 150 years or so. This book presents inspiring examples of innovative housing between 1850 and 1950. Not surprisingly, few are by architects, who tend to have a vested interest in current practice. There's one by an early feminist determined to ease the housewife's lot. Thomas Edison is represented, as are Bucky Fuller and Frank Lloyd Wright. Each example is illustrated and accompanied by analyses placing the work historically, ex-

plaining its underlying philosophy, and revealing its ultimate fate. Fascinating, especially since the move to high-tech housing has yet to be made.

—J. Baldwin

■ At Edison's direction, the system of molds was modified to permit endless variations in the basic plan. In its August 28, 1909, issue *Scientific American* noted this flexibility:

The completed "form" for a single house may require as many as five hundred different sectional molds of cast iron bolted together, but the latter are so designed that a dozen houses in a row may be built on the same cellar plan, the first floor molds being disposable in several different ways, and the second floor molds likewise, so that no two houses of the dozen need to be alike, thus avoiding monotonous uniformity of appearance.

■ The Aluminaire gave many Americans their first real glimpse of an International Style dwelling: sleek, low-maintenance surfaces; large windows making maximum use of natural daylight; built-ins; and a compact, efficient floor plan. Even if the startling, machinelike appearance of the house was not embraced by the majority of new homeowners and their architects, many of the Aluminaire's features began to appear

The panels, light enough to be delivered in pairs on the back of a small truck, could be erected using a simple beam hoist. Here workmen adjust placement of a panel for the small open porch of Polychrome House Number Two.

in American houses in the late 1930s and 1940s. Two-story living spaces, such as the one featured in the Aluminaire, are today commonplace, as are built-in furniture and the use of synthetics to create easy-to-clean, low-maintenance surfaces. The materials used in the house — aluminum and synthetic products — had appeared elsewhere, but their application to residential architecture was new. In the last 50 years aluminum has become a ubiquitous cladding material in America, although not in the form of the square panels envisioned by Kocher and Frey but as horizontal strips that simulate traditional wood clapboarding.



Yesterday's Houses of Tomorrow

(Innovative American Homes 1850 to 1950)

H. Ward Jandl, John A. Burns, and Michael J. Auer, 1991; 224 pp.

\$29.95 (\$33.95 postpaid) from Preservation Press, 1785 Massachusetts Avenue NW, Washington, DC 20036; 800/766-6847 (or Whole Earth Access)



Rain

This skinny but always meaty mag has been around for almost as long as *WER*. *Rain* got its start as an alternative-energy information source, then segued into more community-oriented interests. Over the years, *Rain* has flourished, faded, and flourished once again — a veritable Phoenix. These days, it is one of the best sources for community-building concepts and tools. Its roots are in Eugene, Oregon, a city that has had more than average experience in implementing the ideas that most people on our side of the fence only talk about. There's a bit of New Left tone to it, but no raving. I learn something essential in every issue. *Rain* is back on my must-read list. —J. Baldwin

● In Great Barrington, MA, a low-price popu-



lar hangout, The Deli, had to move when its lease ran out, but the bank wouldn't loan the proprietor the money needed to renovate the new location. SHARE [Self Help Association for a Regional Economy] helped him issue a ten Deli Dollars note, which he sold at US \$9 to customers and friends. This provided him a low-interest loan that he would pay back in prepared food over the following year. He raised \$5,000 in one month. Other community notes followed, side-stepping today's credit crunch and adding the element of trust to

local economics. The Federal Government doesn't care about such local scrip provided it can be exchanged for US currency, and transactions using it remain taxable.



Rain

Greg Bryant and Danielle James, Editors.

\$20/year (4 issues) from P. O. Box 30097, Eugene, OR 97403

Out of Place

If you were parachuted at night into an unnamed town or city, would you be able to tell where you were? Eiffel Towers aside, you probably couldn't. Societal insensitivity and ignorance of ecological diversity leads to not caring much that everyplace is Everyplace these days. This matter is examined in depth in this provoking book. The blight of sameness isn't inevitable. Here's what you need to know to recapture or preserve your own unique local aesthetic. I've not seen this subject discussed so eloquently anywhere else. —J. Baldwin

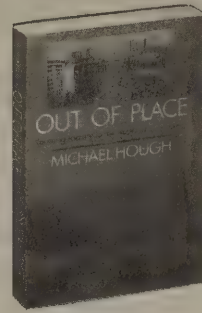
Some years ago I spent considerable time touring the forest districts of Ontario and evaluating forestry practice. In one of the boreal forest management units my party

stopped to look at a clearcut operation in progress, a vast area of cleared forest stretching as far as the eye could see. As we surveyed this dismal scene, a very large Paul-Bunyan-style forester from the logging company stepped up to me, and in a voice that was at once stentorian in volume and caustic in tone, uttered these memorable words: "So you're the guy what's been sent to plant flowers around our clearcuts, eh?"

There seems to be a widespread understanding of aesthetics as some kind of panacea applied to beautify the unfortunate but necessary scars created by the destructive exploitation of natural resources.

Through the media, the visibility of environmental issues everywhere in the world is immediate, vivid, and emotionally involving. At the same time, these media reports have two things in common. First, they are almost inevitably out of town. They are somewhere else: in the diminishing rain forests of Brazil; in the burgeoning population and desperate poverty of Africa; in the dying northern lakes of Canada and Sweden that are succumbing to acid rain generated by polluting industries a thousand miles away. We have the paradox that in a

Oregon. Landscaping the clearcut: aesthetics as the sinecure for beautifying forest destruction.



Out of Place

(Restoring Identity to the Regional Landscape)

Michael Hough, 1990; 230 pp.

\$18 (\$21 postpaid) from Yale University Press/Order Dept., 92A Yale Station, New Haven, CT 06520; 203/432-0940

world increasingly concerned with deteriorating environments and explosive urban growth, there is a marked propensity to ignore the very places where most people live. Second, the issues are so enormously complicated and of such magnitude that most concerned people feel helpless to do much about them.

Beginning where it's easiest, therefore, has to do with where most people are and where one can be reasonably certain of a measure of success from efforts made, no matter how small.



ECOrrrect Woodburning

Now that there are EPA emission standards for wood stoves, the market is inundated with new designs. How do you choose a good one? Here's what I learned in shopping for a new woodstove. My spies generally agree with this:

Despite the wonderful convenience and efficiency of pellet-burning stoves, and the environmentally correct use of "waste" wood to make the pellets, they do not cost less to run than cordwood models, and usually cost a lot more to buy. Moreover, they have two or three power-hungry electric motors, a number of mechanical parts (with wearoutable bearings), and a computer, all of which may prove to be fragile. (If you already have a pellet stove, be sure to protect the computer circuit with a surge suppressor, as you would any computer.) Pellet stoves can't make heat during a power failure, and they cannot burn regular tree wood. If pellet prices rise — they may be artificially low at this intro-

ductory time — you'll have no recourse. And it is not yet clear if pellets make environmental sense after you add in the energy it takes to make and ship them:

High-efficiency cordwood stoves come with and without catalysts. Catalysts must be maintained and replaced from time to time. They aren't cheap (most are \$100-\$300), and they are easy to damage by ineptitude and chemical poisoning from unrecommended fuels such as colored magazine covers and plastic packaging. All work in essentially the same way, so look for high-quality materials and workmanship, and a good warranty.

The better grade of relatively simple, EPA-approved noncatalytic cordwood stoves work fine — many perform as well as the more expensive cat models. As with the cats, they all work in pretty much the same way, despite fervent claims to the contrary. They'll perform well with the increasingly seen fakewood "logs" that make use of the same waste

that's used to make pellets. Go for a name brand with the features you want and a good warranty from a dealer you like. Fuel consumption should drop by about a third compared to most older models. I hear from woodsellers who get around that these are the most trouble-free, and they'll probably cost the least to buy. I'll choose from one of these soon. And it won't look like part of a Civil War locomotive or a TV set, either. —J. Baldwin



BACKSCATTER

Echoes from readers back to *Whole Earth Review* (27 Gate Five Road, Sausalito, California 94965).

We pay \$15 for every letter we publish.

Demysticizing the red-headed friend

I was surprised that you received only one negative reaction to your article, "The Sabbath of Women." Lest you feel deprived by the absence of controversy you expected among *WER* readers, allow me to present an opposing viewpoint.

As a human being equipped with female reproductive organs, I find your attitude about menstruation ludicrous. Clearly you were looking for spiritual meaning in your life, and found it through monthly bleeding.

What I fail to understand is why this bleeding is any more magical than digestion, and eyesight, and circulation, and the myriad other biochemical processes that make us both animal and human. Menstruation defines female just as erection and ejaculation define male. But it is just one of the physiological characteristics that distinguish the sexes. And I equate femininity with that bundle of elements, not just my inherent ability to create new life. Maybe if I could do that alone, rendering sperm superfluous, I might be more impressed by the phenomenon. But blood is blood, whether it's in one's veins or running down one's legs.

I refuse to identify myself with my reproductive tract. Nor can I embrace the popular, romantic attitude about procreation, because I perceive it as god's (or nature's — choose your deity) way of ensuring that the species can perpetuate and evolve. All that separates our reproductive ability from the rest of the animal kingdom's is our capacity to control it — a fact for which I'm deeply grateful, and a skill on which our survival as a species depends.

This concept of "women's wisdom" only exacerbates the sexism so entrenched in so many societies. By propounding that women have a special capacity for spirituality thanks to their bleeding, you suggest

that they are even more distinct from men than is already believed. But I think that men and women are opposite faces of the same coin, and man's sexuality is just as wonderful and important as everything already mentioned. Women should not expect the world to revolve around them when their wombs are shedding, any more than men should expect to be catered to every time their penises become erect. And consider this: is not an erection just as uncomfortable, embarrassing, and distracting as are cramps, a leaking crotch, and PMS? Men have to live with this under widely varying and unpredictable conditions, yet they manage to function every day of the month. As well, the days of retreat and spiritual contemplation you advocate for "moon time" achieve the same effect as any form of recharging. There is nothing unique about the bleeding time, save for the altered-state feeling one gets any time one's chemistry and/or focus undergo a change.

Menstrual blood is a vital body fluid with a specific function. So are semen, sweat, bile, urine, feces, and mucus. The logical extension of your argument is both absurd and disgusting. After all, it's natural and cleansing to have your nose run. Should we thus let snot run down our faces whenever we have a cold? When our bladders or bowels are full, should we squat wherever convenient and let it flow? Or form support groups and discuss the mysticism of evacuation? Shall we applaud each other every time we prove that our inborn systems work? Or herd people into tents for the duration of their discharge and spiritually develop together?

These make as much sense as sitting on moss and bleeding into it. These are just as wholesome and natural. Some of these were done by our ancestors, who were so much more in tune with the earth than our modern, sanitized selves.

Well, these ancestors also had no idea why women bled between their legs roughly every moon cycle. Said ancestors also had hygiene troubles unknown in our time, and they developed fabulous explanations for phenomena they observed but didn't understand. Perhaps we moderns suffer for the loss of spiritual rites, destroyed by technical knowledge. Certainly, there's a flood of new faiths and rituals rising to fill the void. I consider menses worship yet another one. If you study evolution, anthropology, and related sciences, you can't consider it anything else.

Also, this attachment of meaning to physical womanhood leaves out so many women. The lone dissenting letter writer offered one example — those whose organs, for one reason or another, fail to perform as designed. And how about lesbians, who find themselves out of synch with "natural" sexuality, who have learned that personal and sexual identity occur in the mind? What about transsexuals, who found their womanhood imprisoned in a male body? And the hermaphrodites, who are neither and both?

I agree that menstruation should be allowed as a socially acceptable topic and regarded as an important aspect of life. Conversely, it doesn't warrant center stage. Much of what you consider cultural stigma I consider your own susceptibility to influence. I was processed through the same system of conventions you were, and am probably close to you in age, yet I ended up regarding menstruation as fact of life on par with breathing and you ended up regarding it as sacred. I find its impersonal "biologic necessity" as comforting as you find it alienating. I need no auxiliary significance to live with it peacefully and love my self and body. And I find it empowering to carry on with living, or to retreat and restore my psychic balance, regardless what time of month. . . .

Lastly, I protest associating the moon with bleeding. I've never known anyone who menstruates every 29¹/₄ days, with anything near the reliability of moon phases. That association may have been valid in ancestor days when sun, moon, and seasons were the timekeeping mechanisms, and small groups lived in great intimacy. These days the relationship is purely fabricated — another mythos created to fill the void.

I find awe and wonder enough in the sun rising in the east every day, and gravity keeping us attached to the planet. Whoever/whatever designed our amazing bodies and the universe we inhabit is a mystery that engrosses my heart and mind. Menstruation is so minor in the grand scheme of things that I can't get excited about it. Each component of life leads me back to the bigger question, the biggest magic, and limits self-absorption. Which leads me to think that if everyone spent more time looking outward instead of inward, life on earth might be more harmonious.

Carolyn Haley
Troy, New York

Whispers, intrigues, poison & muffled thumps offstage

Kelly Teevan says "I do not have the support necessary to carry out my job," and states that the "task . . . was viewed as insufficiently interesting." The implication is that he came up with a way to grow (and save) the foundation and the magazine, and the staff didn't want to do the work.

Meanwhile, back at the ranch, Howard Rheingold glows about the job Kelly did bringing the whole operation back from the brink, then states that we are sailing into unknown waters again and a brand new Director has been hired. That the New Guy has the ability to grow a business without "sacrificing their artistic integrity." Oh, and that you are going to do new things because they are the right things to do and you are the right people to do them. *Whew* You sure?

That's not even good gossip. There's a hell of a lot of important stuff unsaid. Not reporting to us what bad, nasty thing/plan Kelly suggested that the board and staff (I can only assume) couldn't accept, to the point that the man left/got asked to leave, is pretty unacceptable. Waiting for Jon McIntire to tell us what he's going to do is OK, well it's only fair I guess, but this thing didn't start with him. *Something happened.*

The Org chart says "Note that readers are included." So, This long-time reader wants to know what happened. Complete. In the spirit of the financial reports that USED to appear each issue, blow off a page or two of sexual/lifestyle/drug/VR articles and let us look at the graceful and graceless group process of the community that makes up Point and WER. Please.

Mark Galbraith
Santa Barbara, California

Akira Kurosawa's movie *Rashomon* was about an event that was witnessed by several different people; the film showed the event from each of their viewpoints, and each viewpoint revealed a very different version of the story. The events surrounding Kelly Teevan's departure constituted, in my judgement, a *Rashomon* situation of which at least six people — perhaps as many as twenty — have very different recollections. I thought it was only fair to give Kelly the space to say what he wanted to say, unedited and uncensored. And I said what I thought it was fair and true for me to say. We could have presented all relevant viewpoints, but we

only have 144 pages in the magazine, and I made the judgement that our readers would prefer more reviews and articles to an issue dominated by Gossip. We've been working hard at integrating our different visions of Point and WER, and finding new ways to achieve our goals. The process has been painful at times. We aren't hiding anything. We're growing. I know that everybody who is still around Gate Five Road agrees that we are stronger, rather than weaker, because of the process. —Howard Rheingold

Writhing is our natural posture

I called my sister, Sarah, and asked, "What do you make of all this, 'startling news,' 'casualties,' 'sense of mission,' and 'too much like hard work'?" She replied, "I do believe the old Co-Ev is back."

And now that I've read No. 75, I think she is right. I thought the last few issues were great, but, looking back, they now seem a little more "mainstream" than we expect from WER. They were a little too easy to accept. In personal growth seminars they talk about "leaving your comfort zone," without which there is no possibility for change. It's the same with WER. The fringe of society is where the interesting stuff happens, and is too important to ignore.

What I like to read in WER is articles like "(Slap Slap) Wake Up!" You start out thinking, "this is a crock of shit," but it draws you in with its weird logic, and before the end of the article, you're starting to think differently about your view of the world.

If my sister is correct, then congratulations! You're doing the right thing.

Michael Morse
Garrett Park, Maryland

We're impressed (well, amazed), too

I am impressed, well, amazed is more like it, with the reach of WER. The mail response to my article ["Return of the Peyoteros," WER #75] included: 1) a re-connection with an old caving buddy from high school days; 2) an offer of professional services and help with fundraising for the Huichol from an orchard and forestry guy at UCB; 3) three checks, one of which was for \$5,000.

So the magazine certainly knew where to carry those words.

The \$5,000 will go a long way for the Huichol projects. The donor's letter mentioned a love of Huichol art.

Bret Blosser
Moab, Utah

"Ambivalent" is perhaps not strong enough

Please pardon me for not dragging out the (manual) typewriter, "technophile" that I am. Howard Rheingold's piece in the introduction of "Vigil" [WER #75, p. 4] certainly seems "pro"-technology to me, technology being the compassionate computer technological variety. I don't like what I consider to be Truth labelled an Assumption. (AND I DON'T LIKE BEING KICKED).

I think that the problem your long-term readers & fans (since 1970, sweeties) are having is that 20 yrs. ago you espoused voluntary simplicity & pulling the plug. Now you are flaunting (it seems) how great being plugged in is. For many, like myself, have devoted a lifetime to becoming unplugged. If you love computers, fine, but it stings a bit coming out of my favorite Unplugged Mag.

Someday, maybe, I can see it, when I'm totally solared & can buy the non-radiating, non-polluting kind of word processor. But it's low priority for me. And will probably not happen, since voluntary simplicity turned to involuntary poverty in the '81 recession.

So, it's back to the land, where I am, & where I always wanted to be. Pre-nuke style.

P.S. I do not in any way mean to downplay the importance that the WELL played in Jay Allison's life. I recently went through a "vigil" myself, with a parent. I was deeply moved & touched by the article.

I wish to point out that Howard exhibits an "arrogance," a tone which uses the compassionate to somehow validate the plastic. Not only to validate, but to criticize those of us who are just not with the "program." . . . He infers that computer heads are consciousness-raised, growing, & that the rest of us had better get used to it, whether we own a computer or not!

There's only so much time in a day. We choose what fits us best. I don't need computer consciousness shoved down my throat. It's not a question of good or bad, light or dark, your place or mine.

Just don't put down us little folks out here with our thumbs in the holes in the dyke. HA HA.

OH GOD WHAT HAVE I DONE NOW?

Well, you started it with your lesbian articles, animal penis pictures, & dildo history.

What I mean is, we're out here planting trees and trying to keep "technology" from paving over the little postage stamps of wilderness left. We're not into glorifying the computer. It's a choice.

I can't live it both ways. I don't choose to! Have a Lesbo day!

Terri Scott-Farrin
Kurtistown, Hawaii

Hup! The march of technology continues

I recently found an automatic (mechanical) pencil on the ground of a local college campus. It works well, and I may never go back to using wooden pencils. So I can give away my Blackfeet Indian pencils (WER 64:122) — their quality was deteriorating anyway, especially the erasers — and my Koh-I-Noor sharpener (CQ 33:125). Automatic pencils have only gotten better since CQ recommended them in #30, p. 67. Fine polymer leads produce clean writing. Leads can be easily advanced and retracted. Large, last-a-long-time erasers are available for some models. The one I found, a Pentel QE405, had the drawback of the eraser extending as I wrote until it was so far out it was unwieldy when I went to erase. It extended because the mechanism responsible is the pen barrel turning; when I write I have the habit of turning the pencil to keep a sharp point on the lead, so the barrel was turning. A little duct tape (NWEW p. 132) remedied that, but I've since bought the QE505, which has a tight barrel; no problem. Other drawbacks: the plastic barrels are not absorbent, so when working in a hot situation, like a greenhouse, the pencils become quite slippery. (I'd never noticed the absorbency of wood pencils until I'd switched.) And for a person who carries a pencil behind the ear — and sometimes both ears — the sound of the extra leads carried inside the pencil, muttering around inside there, takes some getting used to. Another brand I'd recommend: Sanford Logo.

I just bought my first fountain pen, also. Can't say much for it, as I promptly left it

at a friend's place 300 miles back there. . . . My greatest worry buying non-disposable writing tools is that I'll lose them, since that was my pattern with the disposables. Maybe just maybe I'll be more careful with the permanent models.

Michael Melius
Hermosa, South Dakota

Four sun-soaked days on Filthy Island

Having just returned from a cruise, there is a facet of the cruiseline industry I must shed light upon.

At our first port, while snorkeling in waters around the cruiseline-owned island, we discovered the ocean floor is littered with plastic glasses bearing the insignia of the cruiseline. Later we found that the island's center is a hollowed out dumpsite for all the ship's plastic (cups, plates, cutlery, etc.) waste. We watched in horror as trailer loads of plastic garbage bags were hauled to the site at the end of the day.

My uneasiness would not go away. In asking a cruiseline employee if the waters were maintained, he informed me that there is someone living on the island full-time, collecting debris. He said they could not recover everything, and that the plastic glasses bear a close resemblance to jellyfish to the unsuspecting Sea Turtle who dines on them, only to die a very slow and painful death. As a result, their numbers are dwindling and the jellyfish population is exploding.

He further said the cruiseline does NOT recycle plastic and styrofoam waste . . . some of the garbage is burned . . . and some is left on the island.

He reported that he was nearly fired from a cruiseline once for standing guard, camera in hand, while cruiseline employees prepared to dump garbage overboard. Although there is a \$5,000 fine to the ship's captain, if caught, the employee said, "ALL THE CRUISELINES DO IT."

When you consider 1500 passengers plus 1200 crew, at a conservative average of 5 plastic cups per day — in one year, that's 4,914,000 plastic cups from ONE ship. There are hundreds of these ships CRUISE/BRUISING our oceans in this very moment.

We had at least 15 pictures taken of us in various poses, both onboard and at port. There were several other photo oppor-

tunities which we ducked. You were never obligated to buy these photos. I overheard a fellow passenger ask the photographer what they did with the unpurchased photos. She sarcastically replied, "We tear them up and make trees out of them."

We won't choose to support these gigantic monster CRUISE/BRUISERS. Will you? Ask yourself. Take a stand.

The irony is that the cruiseline's own livelihood depends on a transformation of its own consciousness . . . as do the gentle creatures of the sea . . . and mankind itself.

Patricia Schwimmer
Egbertsville, New York

Be a cultural organ donor!

This evening I visited the office of a Czech magazine named *Vokno*. Contents is cultural. Thumbing through the current issue, there are articles on (I may be translating this first one wrong because of all the wordplay) "chaotic democracy and menstrual art"; the music of Skinny Puppy; sculpture by Mike Kelley; excerpts from *Last Exit to Brooklyn*; an interview with J. G. Ballard; an interview with "NY Shaman" Michael Medicine Eagle . . . well, you get the idea.

Anyway, the editor asked a favor: they have no hard currency and feel out of touch with new and interesting things published in the US. He asked if *Whole Earth* readers could mail him back issues of mags and zines that are worth reading. The address is:

Blumfeld S. M.
Vokno
Bolzanova 7
110 00 Praha 1
Czechoslovakia

Thanks in advance on their behalf.

Robert Horvitz
Prague, Czechoslovakia

Environmental information urgently needed

I am a Peace Corps volunteer in Czechoslovakia working as an information resources advisor to the Trnava District office of the Slovak Commission for the Environment. One aspect of my job is to develop and provide environmental information to the public. In addition to environmental concerns the Slovaks also



have a great interest in the United States and a very strong desire to learn English. Up-to-date information is difficult to obtain and much of the available information is from government or mainstream sources. I would like your readers to send us back issues of this magazine, and any others they feel are particularly interesting concerning environmentalism in its broadest sense.

I was surprised at first at just how eagerly these types of materials are greeted, and how thoroughly and creatively they are used. Even sending one or two issues will be greatly appreciated. Mail can be sent, surface, to me at Okresny Urad Zivotneho Prostrediva, Kollarova 8, 917 77 Trnava, Czechoslovakia.

Ann M. Hokanson
Trnava, Czechoslovakia

Would it be self-serving to mention that Helping Nature Heal (a Whole Earth Catalog devoted to the subject of environmental restoration) is still available? See page 142 for ordering information.

Uprections & core dates

No. 73: The new address for USGS Map Distribution (back cover and p. 3) is Box 25286, Denver, CO 80225.

No. 74: *Homestead Fire Prevention and Suppression* (p. 11) is available from CPFC, P. O. Box 2214, Redway, CA 95560.

No. 75: The correct phone numbers for MLCS, Ltd., manufacturers of the Merle Clamp (p. 26), are 215/938-5060 or 800/533-9298.

Drawings and instructions for building the Escargot Canal Cruiser (p. 26) are \$80.

The Huichol Art Center (p. 51)'s new address is 12 Excelsior Lane, Sausalito, CA 94965.

"Egg Sex" (p. 94) was excerpted from Susie Bright's new book, *Susie Bright's Sexual Reality: A Virtual Sex World Reader* (\$11.45 postpaid from Cleis Press, P. O. Box 8933, Pittsburgh, PA 15221).

Diseased Pariah Newsletter (p. 107) has new subscription prices and a new ordering address. Domestic subs are \$10/year; Canadian, \$12/year (\$US); international \$20/year (\$US) from DPN c/o Men's Support Center, P. O. Box 30564, Oakland, CA 94604. ☺

A better Pledge

This card is the product of the Sunflower School, a small parental cooperative and "life-long learning collective" in western Pennsylvania.

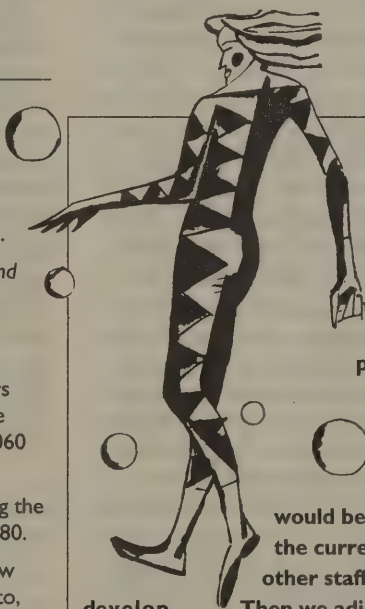
We viewed the U.S. public school pledge of allegiance with some disdain and we entirely avoided it. However, we had some fun rewriting it back in 1987.

Our pledge postcard is put together by the kids and tells it like we want to hear it. And yes, we love our country (although we're perhaps wary of our government).

The going price for the cards is five for a dollar, postpaid.

Joseph Jenkins, Steward
Universal Community of Friends
742 East Gilmore Road
Grove City, Pennsylvania 16127

I pledge allegiance
To all Life
And to the Earth
upon which we live
And to my family
And the World community
One People
One Universe
Indivisible
With Peace, Liberty and
Justice
For All



Think Globally, Dance Locally

How about some face-to-face fun combined with some occasional weird stuff? "Think Globally, Dance Locally" is a motto emailed in by one of our readers. We received it on the very day that the idea for a kind of discussion/dance/party event came up in a meeting. We want to try to do one with the release of each issue and it might go something like this. You show up at a preannounced place, initially in the San Francisco Bay Area. The first part of the evening would be getting together with a few contributors from the current and just-past issue, plus some WER editors and other staff, and, lo and behold, some interesting discussions develop. Then we adjourn to the adjoining room where a band plays this really groovy music and, unable to keep still, we all undulate, swing and sway, leap and lizard the night away. We would like these events to be FUN, first and foremost, augmenting our printed pages with some real live humans who walk, talk, and dance. It would also be great if the events could show a small profit. Small sums of money coming in can make a big difference toward paying contributors and staff more, one of the things to try instead of including advertising in the magazine.

The first event will take place at the Fort Mason Conference Center (Building A) in San Francisco, Saturday, September 19. To listen/discuss/mingle, plan to arrive at 7:30 pm; if you'd rather just dance, show up around 9:30. We're charging \$15 for the full evening, \$10 for the dance only. —JMcl

Gossip

I did tell you to fasten your seatbelts in the previous issue's Gossip. Since then, Keith Jordan got married, Janu Stein joined WER as book-keeper (working with our accountant, Christine Goodson), Lorry Fleming replaced Robin Bishop as editorial assistant, WER managing editor Jonathan Eveleigh (in his words) "got hung, drawn, and quartered," WELL director Cliff Figallo resigned, WELL general projects manager Nancy Rhine resigned, and WELL Internet project coordinator John Hoag resigned. Lisa Winer is WER's new data-entry clerk. Yibing Ma has joined the WELL's programming staff. Maurice Weitman is the WELL's new general manager. And WER editor Rheingold is off on a quest.

Longtime readers will recognize the word "sabbatical" as an inhouse euphemism for "adios." In the WER tradition of reversing WER traditions, I'm going to make an exception in this case. I'm off on the trail of a book about virtual communities. The next three issues will be guest-edited. And then I intend to return to take us all on some wholly different tack. We've made arrangements for guest editors who are going to do us all some good.

I will leave it up to the next editors to announce their successors, but it is my pleasure to announce that the next issue will be edited by the entire staff of WER. In the words of Jonathan E., "the inmates will take over the asylum." I think it's a great idea. The staff is extraordinary and they'll dig up some great stuff. I can sit back and read the magazine as a reader again. Maybe they will discover they won't need an editor, in which case I will be doing the right thing. Wouldn't that be cool?

Jonathan E. is gone. My short take on this particular version of Rashomon at Gate Five Road is that there was a genuine disagreement among many members of the staff about the future direction of the organization, and one of the results of the decisions that we all made together about the future was Jonathan's demise. I'll miss contending with you, Jonathan. You are a truly dedicated champion of quality, and a man who does a great job of living in his own movie. You made me a better editor than I could have become on my own.

Lorry Fleming stepped bravely into a position she knew to have burned out three editorial assistants over the past three years.

It does sound like life has been weird at Gate Five Road, and indeed it has, but what isn't



Keith and Cassandra and friends, atop Bernal Hill.

visible in these brief notes is the process of growth we've been struggling through. We are indeed growing toward something, not disintegrating. A lot of things needed changing, and they have been changing in a far more conscious way than ever before.

Lorry is part of that. She helped us redesign the editorial-assistant position so it would no longer be a burnout. It's working so far, though she's only a few months into it. Lorry has worked in the independent-music world and the offbeat end of the magazine world. After RE/Search magazine, WER doesn't seem so strange.

Over the past six years, Cliff Figallo took the WELL from a pioneer colony of 600 explorers on the edge of cyberspace to a thriving and internationally recognized virtual community of 6,500 and still expanding daily. The WELL has been going through growing pains, and director/chief scapegoat of the WELL is a tough row to hoe for six years. Cliff is leaving amicably. In fact, he helped us pick his successor, Maurice Weitman, who has been on the WELL almost as long as Cliff. We're all excited about Maurice, who has already taken the helm and started doing all the right things for a new general manager to do. Maurice has extensive management experience in software service businesses, and a deep understanding of the WELL's culture.

Cliff has accepted the job of Director of the Electronic Frontier Foundation's office in Cambridge, Massachusetts. We expect a strong alliance between EFF and WELL to continue.

Nancy Rhine created the customer support department at the WELL; she and John Hoag, another much-loved WELL user and staffer,

have started a new consulting company, International Telecom Associates.

With Jon McIntire leading Point and Maurice leading the WELL and The Staff Itself leading WER, we are indeed sailing off into uncharted waters with more confidence than we've had in a long time — maybe ever. It hasn't been easy becoming something newer and better than just a couple of maverick enterprises Stewart Brand started, but the consensus among the survivors is that we're getting there.

Back on dry land, Keith Jordan and Cassandra Shafer were married May 23 on Bernal Hill in San Francisco. It was a sunny day. Irish eyes were smiling.

The next three issues will be fun. I wouldn't have left if I didn't know that. See you next summer. —Howard Rheingold

Women Wanted: No Qualifications

The Spring 1993 issue of WER will be edited by Jon Carroll, a columnist for the San Francisco Chronicle and former editor of New West and other publications of varying quality. One of the themes of the issue is Real-Life Women; he would be interested in getting narratives, reports, or documents from or about unusual, surprising, admirable, colorful, opinionated, or unexpected women. No rhetorical flourishes, please, no manifestos; just facts, anecdotes, day-to-day specifics, strategies, advice, shapes, colors, emotions, experiences. Nouns and verbs preferred; adjectives and adverbs optional. ☺

Oh well, gulp, here goes . . .

BY JON MCINTIRE

When Stewart asked me to consider being Point director, I had just received several other project offers; I said "no," but that I'd be willing to look into and discuss how Point might attract someone like me. I didn't want to be engulfed with business concerns which would make it impossible to satisfy my creative needs. This was the predicament in which I found myself as manager of the Grateful Dead (I've filled various management positions with the Dead, off and on, for much of my life — began in 1968, ended my last five-and-a-half-year stint in 1990). Creativity is certainly involved in helping to solve the problems that surround a group as unusual as the GD, but it's not the same kind of get-off as writing, acting, stage directing, or graphic art — other things I've done.

I left my position with the Dead to pursue other projects, in particular the Global Teenager TV project, which started in the pages of *WER* (#65, p. 2). When it became clear that the Point director would not have to deal mainly with business details, but would be a kind of impresario, creating and following up on new projects, I began to reconsider. Point seemed like a good place to learn and do, a good match for my ideals, desires for creative expression and community, and a good use of the rather unusual configuration of talents and experience I have picked up on my way here.

As an extreme individualist with collectivist dreams, I like the idea that community can support and free you to be more yourself, reinforce our differences as positive contributions to the whole.

It seems to me that most all organizations are dysfunctional; we all need to work together better: to work on "process," to overcome fear, to help each other cut through the untenable aspects of egotism and cupidity. You may think "the system is a four-letter word," but the system is what we make it, and what we let it be. I spent three years working with a group of men and women in St. Louis who endeavor to diminish men's violence against women — RAVEN (Rape And Violence End Now). My work there as a peer counselor, public speaker, and staffer was informed by the large amount of attention we gave to the way we worked with each other, the skepticism with which we treated our expecta-

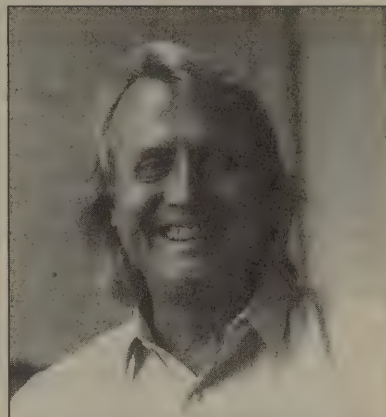
tions of ourselves as men, and our questioning of our concepts of power. I learned some techniques for dealing with altercations between people, helping people to listen and communicate better. And ways of asking myself questions about how I do what I do.

I'm told there are no taboos here; I'm tempted to test that. No taboos means, among other things, more chance of identifying your blind spots, preconceptions, and tacit hierarchies. But that probably means that, from time to time, something here will offend. I hope the frequent result will be that you rethink some of your opinions; that you'll be challenged by a viewpoint or information you hadn't considered.

The heart of Point is *Whole Earth Review*. All projects should enhance the magazine and have a certain integrity with its eclectic, experimental tone. It's a bit questionable to speak so soon of the kinds of projects I would like to generate from here; who knows what resistance or synergies will occur as we pursue the possibilities? But further on I will speculate on things we might try.

I'd like to help increase our circulation. Staff and contributors should be better paid. This is difficult to accomplish because we do not accept advertising, the major source of revenue for most publications. It is possible to view certain advertising as dispersing useful information, but presently this is seen as a path strewn with pitfalls; your feedback would be welcome. Direct-mail campaigns, while loathsome, are one way to increase circulation. Various projects could raise the magazine's profile.

In addition to reviews and shorter articles I would like to encourage some longer pieces, such as "Hear That Long Snake Moan" by Michael Ventura (*WER* #54 & 55). In an era of ever-decreasing attention spans it is important to preserve more thorough forms of weaving thoughts into a rich context; understanding can go deeper, can have unanticipated results. The fewer the places where such thinking is offered, the more important they become to our species' relationship to depth, satisfying meaning. I like the way *WER* can give readers the kind of insight that you normally get from the best fiction: the intimacy of the



voice of a writer like Michael Ventura is a conduit for multiple levels of information, some conscious, mostly unconscious.

So what are we trying to do here? We start from the belief that our thoughts, actions, the ways we care for one another, can make a difference. There is a bewildering array of ideas, books, and tools out there. It remains the mission of *WER* and Point to point out interesting and potentially effective possibilities.

I like the fact that it is hard to categorize this publication; that gives us the freedom to try many ways of giving "access to tools." The very concept of "tools" is broadened, pushed beyond the literal, obvious interpretations.

Projects we're considering include a book series (examples: guides to grassroots political tools, social services that work, taming technology, and more); interactive multimedia products, some of which may overlap with book projects; conferences, of both the real-time/face-to-face and the ethereal/computerized variety; events related to our twenty-fifth anniversary (June '93); and a series (we hope it's a series) of combined discussion/dance parties: Think Globally, Dance Locally (we hope the first one will be this September. See box, page 133).

I feel very fortunate to be here, believe it to be a promising fit. This is a place where good work is done. Perhaps I can add some touches that will broaden its influence. Being here has already involved a bunch of ups and downs and still feels worth doing. I look forward to seeing what we can do together; hope you find the results rewarding. ☺

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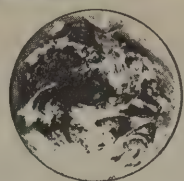
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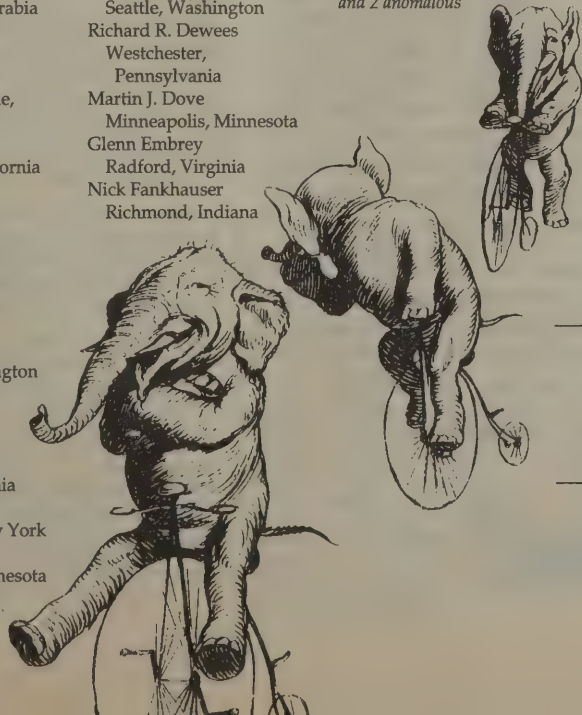
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Point Foundation 1991 Financial Report

Balance Sheet as of December 31, 1991

Assets	
46,856	Cash
93,242	Accounts Receivable
1,575	Inventory
17,923	Fixed Assets Less Depreciation
40,675	Other Assets
200,270	Total Assets
Liabilities	
47,174	Accounts & Contracts Payable
524,974	Subscription Liability
572,148	Total Liabilities
-371,877	Fund Balance

1991 Income & Expenses

Income	
414,628	Subscription Income
15,790	Back Issue & Single Copy Sales
181,233	Newsstand Sales (after Returns)
25,903	Book & Product Sales
9,938	Royalties
25,300	Chronicle Column
19,717	List Rental
8,552	Unclassifieds
15,955	Contributions
12,767	Other Income
729,782	Total Income
Expenses	
335,251	Payroll & Related Expenses
114,746	Printing WER
27,570	Writers & Illustrators
11,732	Editorial/Production Expenses
91,294	Fulfillment/Promotion Expenses
24,290	Newsstand Expenses
17,560	Book & Product Sales Expenses
19,735	Chronicle Column Expenses
51,327	Rent, Maintenance & Utilities
4,215	Insurance & Taxes
9,493	Office & Computer Supplies
9,046	Depreciation
16,469	Postage & Phone
21,566	Other Expenses
754,293	Total Expenses
-24,511	Net Change in Fund Balance

The accompanying 1991 Financial Report is for informative purposes only and should not be seen as an Official Financial Statement. Some changes may yet be made before the books for the year are closed. If you would like to see a copy of our final, full 1991 Financial Statement, please request one by mail.

Beginning with our next issue, we will return to publishing a quarterly report. We will also include some not-strictly-financial information (such as: number of new subscribers, ranking of sources for new subscribers, number of newsstand copies distributed, etc.). If there is anything you'd especially like to see, drop me a note.

One new element in this report is the inclusion of our balance sheet (assets and liabilities as of the end of the year). As with other magazines, we have a large subscription liability (the value of the copies of *Whole Earth Review* still owed to current subscribers). That liability is larger than our tangible assets. What our balance sheet does not take into account is our intangible assets: the value of the business, subscriber base, subscriber good will, our good name, etc.

We show a change in fund balance for last year of -\$24,511. 1991 was a transition year in many ways. We raised our renewal price and our cover price. We chose not to try to get large numbers of subscribers to renew a year (or more) in advance (because that works out in practice as borrowing from the future — those subscribers are then not there to renew a year or two hence). And now we have a new Executive Director whose job it is to develop new projects that will have a symbiotic relationship with the magazine, both editorially and financially (see message from Jon McIntire on page 135).

The price increase and the patience in foregoing early renewals is paying off; we are on a good footing for 1992. We'll report on some of the details of 1992 and beyond in our next issue. —Keith Jordan

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The Unclassifieds are a reader-to-reader service available to *WER* subscribers only. They're designed to provide a cheap communication network for *WER* readers and mild financial assistance to the magazine.

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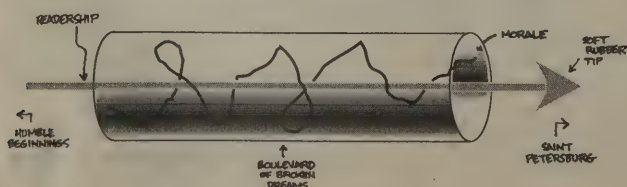
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- **We print ads in the order received.** "Unclassifieds" means "no categories."
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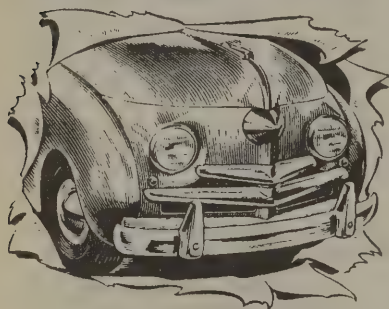
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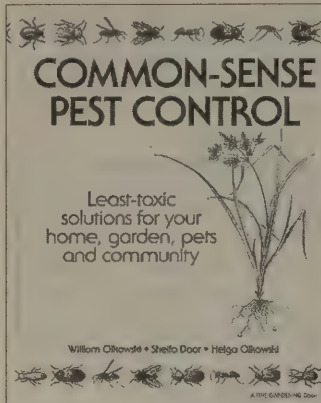
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—Richard Nilsen,

Whole Earth Review #73.

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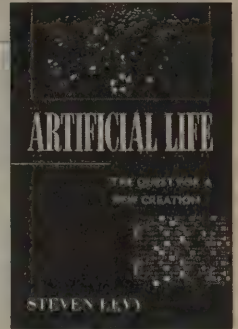
Artificial Life

by Steven Levy

Science journalist Steven Levy, author of *Hackers* (WER #46), tells how scientists from different disciplines are using the power of computers to generate, evolve, and observe artificial life.

While A-life holds the promise of helping us to understand the path of evolution or to engineer new virus-killing molecules, it may also lead to the creation of artificial offspring that could evolve beyond our ability to control them.

As WER editor Howard Rheingold says in



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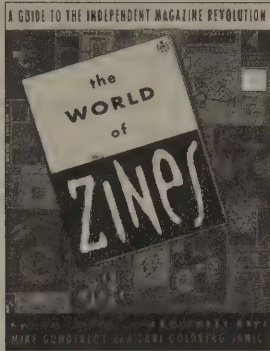
his introduction to the excerpt from *Artificial Life* in this issue, "Whatever we decide about creating or not creating possible successors, humans ought to make that decision before we lose control of the process we started. To talk intelligently about where a powerful new technology might lead, we have to understand what it is."

1992. Hardcover, 390 pages, with index and 11 color plates. \$26 postpaid.

The World of Zines

(A Guide to the Independent Magazine Revolution)

by Mike Gunderloy and Cari Goldberg Janice, Editors of *Factsheet Five*



Whole Earth Review has regularly featured Mike and Cari's gleanings from the more than 10,000 small magazines — "zines" — being published today in the US. They are the world's foremost experts on zinedom, having chronicled these publications since 1982 in the pages of *Factsheet Five*.

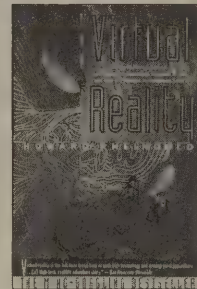
The World of Zines provides a window on the zine world with information that includes:

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by Howard Rheingold

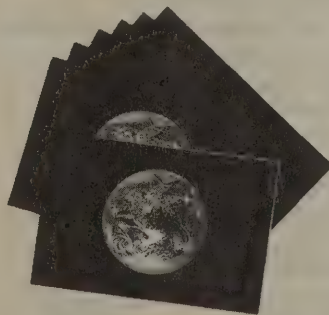
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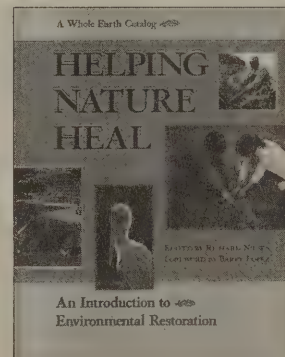


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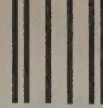


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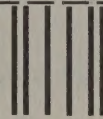
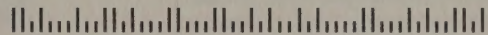
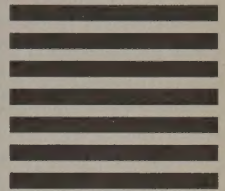
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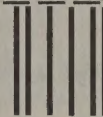
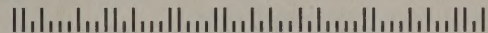
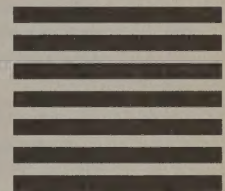
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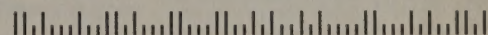
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74. Spring 1992 — The Goddess Is Alive: women's wisdom from Z Budapest and Paula Gunn Allen; reviews of pagan zines; reflections of an outlaw volunteer; fighting for the forests: negotiating tactics, tools and resources for forest activists; robot Olympics; Brian Eno on world music; the coevolution of governance; reviews of maps and atlases. **\$7.**

73. Winter 1991 — Questioning technology; Jerry Mander, Langdon Winner, Howard Levine, Peter Calthorpe, J. Baldwin, Ivan Illich, Amory and Hunter Lovins, William Calvin, and others debate the merits, drawbacks, and outcomes of various technologies. **\$7.**

72. Fall 1991 — Extending human perception with Nightwalking, lucid dreaming, virtual reality, psychedelics, and Neuro-Tarot; cultural survival of Hawaiians, Mayans, and Tibetans; eldercare; Art Kleiner on corporations. **\$7.**

71. Summer 1991 — Global and local electronic networking by citizen activists; myths and dreams — interviews with Wendy Doniger and James Hillman; storytelling, from multimedia to native American traditions; "Snake Talk," by Anne Herbert; Lara Owen on menstruation; Ecuadorian shaman Mercedes Mamallacta. **\$7.**

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69. Winter 1990 — Access to Japan, including: the origins of Japanese group-mindedness; Michael Phillips on US-Japan relations; Bruce Sterling on Japanese pop music; the role of whaling in Japanese culture; Japanese environmental groups. Plus Murray Bookchin and Dave Foreman. **\$7.**

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63. Summer 1989 — Is the body obsolete?: downloading humans into computers; how culture shapes bodies; opinions by Susan Griffin, William Burroughs, and others; environmental idealism in Costa Rica; and a section on feminist journals, women and martial arts. **\$7.**

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Tibet as the Tibetans see it (detail shown). For more on the Illustrated Map of Tibet, see page 112.